

CHAPTER 3

AFFECTED ENVIRONMENT

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Introduction and Study Area

This chapter describes the natural and socioeconomic environment of public lands in the western U.S., including Alaska, which would be affected by the alternatives under consideration. It includes the resources that were identified in Chapter 1, and provides a framework for understanding the environmental, cultural, and social consequences of the proposed program and alternatives. In many instances, the sections in this chapter reference material provided in the affected environment chapter of the 2007 PEIS, rather than repeating the full discussions here. However, updated information is provided, where relevant.

Land Use and Ecoregions

Land Use

The BLM manages approximately 247 million acres in the western U.S. and Alaska. Public lands make up less than 0.1 percent of the total land area in some states, up to approximately 68 percent of lands in Nevada (Table 3-1).

The BLM manages activities and resources on rangelands throughout the West to ensure that fundamental rangeland health is being sustained or improved. The BLM permits livestock grazing on public lands in a manner aimed at achieving and maintaining rangeland health.

Other public uses on BLM-administered lands include oil, gas, geothermal, and mineral development, various types of recreation, forestry (harvest of timber and other forest products), and cultural activities. Roads and trails on BLM-administered lands support various forms of travel, including OHV use and other motorized travel, as well as non-motorized forms of travel such as mountain bike, horse or pack animal, and foot. Additionally, rights-of-way support petroleum pipelines, electrical transmission lines, and other utilities.

Land use planning is directed by BLM Handbook H-1601-1 (*Land Use Planning Handbook*; BLM 2005). This document provides guidance for preparing,

revising, amending, and maintaining land use plans. Land use plans are developed with public input, in accordance with the FLPMA, which requires the BLM to manage public lands and their various resource values to support multiple uses and sustained yields.

TABLE 3-1
Acres of Public Lands in 17 Western States and
Percent of the State Administered by the BLM

State	Acres of BLM Land	Percent of State Lands Administered by the BLM
Alaska	72,594,739	20.0
Arizona	12,202,750	16.8
California	15,330,274	15.3
Colorado	8,332,880	12.5
Idaho	11,611,720	21.9
Montana	7,983,412	8.6
Nebraska	6,354	0.2
Nevada	47,794,096	68.0
New Mexico	13,484,412	17.2
North Dakota	58,841	0.2
Oklahoma	1,975	0.2
Oregon	16,135,531	26.1
South Dakota	274,437	0.4
Texas	11,833	<0.1
Utah	22,854,632	43.3
Washington	429,167	0.9
Wyoming	18,373,316	29.4
Total	247,480,369	100

Source: USDOI BLM 2012a. Acreages are approximate and subject to change in response to land transfers.

Ecoregions

Because this PEIS addresses a broad geographic region with a diverse range of biophysical characteristics, the study area has been subdivided into smaller, homogeneous areas for analysis. Where possible, information on resources has been organized by ecoregions rather than by state boundaries. Ecoregions are geographic areas that are delineated and defined by similar climatic conditions, geomorphology, and soils (Bailey 1997, 2002). Since these factors are relatively constant over time and strongly influence the ecology

of vegetative communities, ecoregions may have similar potentials and responses to disturbance (Clarke and Bryce 1997; Jensen et al. 1997). Ecoregions, therefore, provide a useful framework for organizing, interpreting, and predicting changes to vegetation following management treatments.

The public lands addressed in this PEIS lie within eight major physiographic regions, or ecoregion divisions: Tundra, Subarctic, Subtropical Steppe, Subtropical Desert, Temperate Steppe, Temperate Desert, Mediterranean, and Marine, including Mountain Provinces (Map 3-1).

Climate

Climate is the statistical distribution of atmospheric conditions, as determined by the weather patterns that result from long-term fluctuations in global atmospheric and hydrologic cycles. Climatic patterns describe the annual distribution of energy and moisture, thus affecting the amount and seasonal distribution of temperature, precipitation, and winds. These factors influence the composition and distribution of rangeland vegetation, as well as the formation and erosion of rangeland soils, and hydrological conditions. These factors also influence the distribution of wind-borne air pollutants, such as smoke from wildfires and prescribed fires.

The western U.S. experiences several broad climatic groups: polar, boreal, temperate, Mediterranean highland, and dry. Polar and boreal climates dominate in Alaska, while a humid temperate climate is characteristic of the coastal areas of Washington, Oregon, and northern California. The southern California coast has a Mediterranean climate, while mountainous areas have a highland climate. The rest of the western states east of the Cascade, Sierra Nevada, and Rocky mountains are characterized by a dry climate.

The 2007 PEIS presents specific information on the climate within each of the eight ecoregions (USDOI BLM 2007a:3-2 to 3-4).

Air Quality

Background information on air quality standards and pertinent regulatory information is presented in the 2007 PEIS (USDOI BLM 2007a:3-3 to 3-4). Under the authority of the Clean Air Act, the USEPA sets primary and secondary National Ambient Air Quality Standards (NAAQS) for the criteria pollutants sulfur dioxide

(SO₂), nitrogen dioxide (NO₂), carbon monoxide (CO), ozone (O₃), lead (Pb), and particulate matter (PM₁₀ [less than 10 microns in diameter] and PM_{2.5} [less than 2.5 microns in diameter]). Primary standards protect the health of sensitive individuals, and secondary standards protect the general welfare of the public.

The most recent NAAQS are listed in Table 3-2. Different averaging periods are established for the criteria pollutants based on their potential health and welfare effects. The NAAQS are enforced by states, which in some cases have adopted additional or more stringent standards. Each state develops a plan describing how it will attain and maintain the NAAQS. Air quality agencies send these plans to the USEPA for approval.

Geographic areas that meet the standards are attainment areas and those that do not meet the standards are nonattainment areas. Nonattainment areas must implement a plan to reduce ambient concentrations below the NAAQS. Once they comply with the standards, they are designated as maintenance areas. Table 3-3 lists counties with public lands that are designated as nonattainment or maintenance areas for each criteria pollutant. PM, O₃, and NO₂ concentrations are expected to be higher near industrial areas and cities where there are significant combustion sources and vehicles. High SO₂ concentrations occur primarily near coal-fired power plants, smelters, and refineries.

Detailed sources of information about existing air quality in the areas covered by this PEIS are limited to data from available monitoring sites for criteria pollutants. In the undeveloped regions of public lands, ambient pollutant levels are expected to be low, and probably negligible in remote areas. In general, locations experiencing high ambient pollutant levels in the treatment area are areas with commercial and industrial land use (areas with mills, power plants, etc.), and local population centers (areas with automobile exhaust, residential heating, etc.).

Greenhouse Gas Emissions and Climate Change

Climate change is a global issue that refers to any significant change in measures of climate, including temperature, precipitation, or wind, that extends for a period (decades or longer) of time. Climate change is a result of natural factors, such as volcanic eruptions, and land use and burning of fossil fuels (USEPA

TABLE 3-2
National Ambient Air Quality Impact Significance Criteria

Pollutant	Averaging Period ¹	NAAQS		PSD Increments ²	
		Primary	Secondary	Class I	Class II
NO ₂	1-hour	100 ppb	NA	NA	NA
	Annual	53 ppb	53 ppb	2.5 µg/m ³	25 µg/m ³
CO	1-hour	35 ppm	NA	NA	NA
	8-hour	9 ppm	NA	NA	NA
PM ₁₀	24-hour	150 µg/m ³	150 µg/m ³	8 µg/m ³	30 µg/m ³
	Annual	NA	NA	4 µg/m ³	17 µg/m ³
PM _{2.5}	24-hour	35 µg/m ³	35 µg/m ³	2 µg/m ³	9 µg/m ³
	Annual	12 µg/m ³	15 µg/m ³	1 µg/m ³	4 µg/m ³
SO ₂	3-hour	75 ppb	NA	25 µg/m ³	512 µg/m ³
	24-hour	NA	0.5 ppm	5 µg/m ³	91 µg/m ³
	Annual	NA	NA	2 µg/m ³	20 µg/m ³
Lead	Rolling 3-month average	0.15 µg/m ³	0.15 µg/m ³	NA	NA
O ₃	8-hour	0.075 ppm	0.075 ppm	NA	NA

¹ Annual standards are never to be exceeded. Short-term standards (those other than annual or quarterly) are not to be exceeded more than once per year, except for O₃, PM₁₀, and PM_{2.5} standards. For O₃, the expected number of days with ozone levels above the standard is not to be exceeded more than once per calendar year. For PM₁₀, the standard is attained when the 99th percentile concentration for the year is less than the standard. For PM_{2.5}, the standard is attained when the 98th percentile concentration for the year is less than the standard.

² Prevention of Significant Deterioration (PSD) increments are the maximum amounts of pollutants allowed above a specified baseline concentration. Class I areas are predominantly large national parks and wilderness areas as of August 7, 1977. Class II areas include a variety of areas, such as national monuments, recreational areas, preserves, lakeshores, and wild and scenic rivers.

NA = Not applicable; ppb = parts per billion; ppm = parts per million; and µg/m³ = micrograms per cubic meter.

Sources: USEPA 2012b; 40 CFR 52.

2010a). Anthropogenic activities such as deforestation and fossil fuel combustion emit heat-trapping GHGs, which are defined as any gas that absorbs infrared radiation within the atmosphere. The heat absorption potential of a GHG is referred to as the Global Warming Potential. Each GHG has a Global Warming Potential value based on the heat-absorbing ability of the GHG relative to CO₂. The carbon dioxide equivalent (CO₂e) for a gas is derived by multiplying the tons of the gas by the associated Global Warming Potential of the gas. Greenhouse gases, both naturally occurring and anthropogenic, prevent heat from escaping the atmosphere and thereby regulate the Earth's temperature. Anthropogenic sources of GHGs have elevated GHG concentrations within the atmosphere, which has led to an increase in the Earth's average surface temperature over the last century (USEPA 2010a).

Unlike criteria air pollutants and toxic air contaminants, which are of regional and local concern, GHGs are global pollutants. They have the ability to affect global

temperatures due to their heat trapping ability, and are therefore often discussed from a global perspective. There are six recognized GHGs: CO₂, chlorofluorocarbons, methane, nitrous oxide (N₂O), O₃, and water vapor. The federal Clean Air Act now regulates these six GHGs. While certain sources are required to meet the USEPA's final GHG Reporting Rule (74 FR 56260; 25,000 metric tons [MT]), other types of projects (including the proposed herbicide treatments) are not required to meet these rules.

The revised draft CEQ guidance for NEPA analysis uses 25,000 MTCO₂e annual emissions as a reference point for identifying projects that require quantitative analysis of GHG emissions (CEQ 2014), although this reference point is for the purposes of disclosure and not a substitute for a determination of significance under NEPA. Additionally, the guidance states that land management agencies should consider net GHG emissions that would occur with and without the proposed project.

TABLE 3-3
Counties Within the Treatment Area that are Designated Nonattainment or
Maintenance Areas for Various Pollutants

Pollutant	State	Nonattainment	Maintenance
PM _{2.5}	Alaska	Fairbanks North Star Borough*	None
	Arizona	Pinal*, Santa Cruz*	None
	California	Alameda, Butte*, Contra Costa, El Dorado*, Fresno, Imperial*, Kern*, Kings, Los Angeles*, Madera, Marin, Merced, Napa, Orange, Placer*, Riverside*, Sacramento, San Bernardino*, San Francisco, San Joaquin, San Mateo, Santa Clara, Solano*, Sonoma*, Stanislaus, Sutter, Tulare, Yolo*, Yuba*	None
	Idaho	Franklin*	None
	Montana	Lincoln*	None
	Oregon	Klamath*, Lane*	None
	Utah	Box Elder*, Cache*, Davis, Salt Lake, Tooele*, Utah*, Weber*	None
	Washington	Pierce*	None
PM ₁₀	Alaska	Anchorage Municipality*, Juneau City and Borough*	None
	Arizona	Cochise*, Gila*, Maricopa*, Pima*, Pinal*, Santa Cruz*, Yuma*	Gila*, Mohave*
	California	Imperial*, Inyo*, Kern*, Los Angeles*, Mono*, Orange, Riverside*, Sacramento, San Bernardino*	Fresno, Inyo*, Kern*, Kings, Madera, Merced, San Joaquin, Stanislaus, Tulare
	Colorado	None	Adams*, Arapahoe*, Archuleta*, Boulder*, Broomfield, Denver, Douglas, Fremont*, Jefferson, Pitkin*, Prowers*, Routt*, San Miguel*
	Idaho	Bannock*, Bonner*, Power*, Shoshone*	Ada*, Bannock*, Power*
	Montana	Flathead*, Lake*, Lincoln*, Missoula*, Rosebud*, Sanders*, Silver Bow*	None
	Nevada	Clark*, Washoe*	None
	New Mexico	Dona Ana*	None
	Oregon	Lane*	Jackson*, Josephine*, Klamath*, Lake*, Union*
	Utah	Salt Lake, Tooele*, Utah, Weber*	None
	Washington	None	King*, Pierce*, Spokane*, Thurston*, Walla Walla*, Yakima*
	Wyoming	Sheridan*	None
SO ₂	Arizona	Pinal*	Cochise*, Gila*, Greenlee*, Pima*, Pinal*
	Montana	Lewis and Clark*, Yellowstone*	None
	Nevada	None	White Pine*
	New Mexico	None	Grant*
	Utah	Salt Lake, Tooele*	None
NO ₂	None	None	Los Angeles*, Orange, Riverside*, San Bernardino*
CO	Alaska	None	Anchorage Municipality, Fairbanks North Star Borough*
	Arizona	None	Maricopa*, Pima*

TABLE 3-3 (Cont.)
Counties Within the Treatment Area that are Designated Nonattainment or
Maintenance Areas for Various Pollutants

Pollutant	State	Nonattainment	Maintenance
CO (cont.)	California	None	Alameda*, Butte*, Contra Costa*, El Dorado*, Fresno*, Kern*, Los Angeles*, Marin*, Napa*, Orange, Placer*, Riverside*, Sacramento*, San Bernardino*, San Diego*, San Francisco, San Joaquin*, San Mateo*, Santa Clara*, Solano*, Sonoma*, Stanislaus*, Yolo*
	Colorado	None	Adams*, Arapahoe*, Boulder*, Broomfield, Denver, Douglas*, El Paso*, Jefferson*, Larimer*, Teller*, Weld*
	Idaho	None	Ada*
	Montana	None	Cascade*, Missoula*, Yellowstone*
	Nevada	None	Carson City*, Clark*, Douglas*, Washoe*
	Oregon	None	Clackamas*, Jackson*, Josephine*, Klamath*, Lane*, Marion*, Multnomah*, Polk*, Washington*
	Utah	None	Utah*, Salt Lake*, Weber*
	Washington	None	Clark*, King*, Pierce*, Snohomish*, Spokane*, Yakima*
Ozone	Arizona	Maricopa*, Pinal*	Pinal*
	California	Alameda, Amador, areas of Indian Country, Butte, Calaveras, Contra Costa, El Dorado*, Fresno, Imperial, Kern*, Kings, Los Angeles*, Madera, Marin, Mariposa, Merced, Napa, Nevada*, Orange, Placer*, Riverside*, Sacramento, San Bernardino*, San Diego*, San Francisco, San Joaquin, San Luis Obispo*, San Mateo, Santa Clara, Solano*, Sonoma*, Stanislaus, Sutter*, Tehama*, Tulare, Tuolumne, Ventura*, Yolo	None
	Colorado	Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson, Larimer*, Weld*	None
	Nevada	Clark*	None
	New Mexico	None	None
	Oregon	None	None
	Utah	None	None
	Wyoming	Lincoln*, Sublett, Sweetwater*	None
Lead	California	Los Angeles*	None
	Montana	Lewis and Clark*	None
<p>* Only a portion of the county is in nonattainment or maintenance for the pollutant.</p> <p>Notes: States that are not listed for a particular pollutant do not have counties within the treatment area that are also within nonattainment or maintenance areas for that pollutant.</p> <p>Source: USEPA 2012c.</p>			

For analysis of the proposed herbicide treatments, comparing projected GHG emissions to regional or national GHG emissions provides an understanding of the relative contribution of the action to total GHG emissions. The emissions can also be considered in terms of federal goals for GHG reductions, such as those described in EO 13693, *Planning for Federal Sustainability in the Next Decade*. There are more sources and actions emitting GHGs than are typically encountered when evaluating the emissions of criteria

pollutants or toxic air contaminants. The global climate change problem is much more the result of numerous and varied sources, each of which might make a relatively small addition to global atmospheric GHG concentrations, but that together have a cumulative effect. While there are difficulties in attributing specific climate change impacts to any given proposed action and quantifying those impacts, projected GHG emissions can be used as a proxy for assessing a proposed action's potential climate change impacts.

Class I Areas and Visibility Protection

Under the Clean Air Act, the U.S. has designated certain national parks, wilderness areas, and Indian reservations as Prevention of Significant Deterioration (PSD) Class I areas (Map 3-2). These areas are considered pristine and are therefore afforded special protection from impacts associated with air pollution. Mandatory Class I areas, which include large national parks and wilderness areas that were in existence on August 7, 1977, are a subset of Class I areas that may not be redesignated, and are subject to visibility protection regulations. Additional information on policies related to visibility protection is presented in the 2007 PEIS (USDOI BLM 2007a:3-4 to 3-6).

Herbicide Drift

Aerial and ground application of herbicides may transport herbicides through drift, allowing airborne herbicides to move beyond the intended target. The primary factors that influence drift are droplet size, wind speed, humidity, formulation of the herbicide, height of application, equipment and application techniques, and the size of the area treated with the herbicide. The factor that has the greatest influence on downwind movement is droplet size. Procedures that can be employed to reduce drift include: 1) using a lower spray nozzle height, 2) using the lower end of the pressure range, 3) increasing the spray nozzle size, 4) using drift-reducing nozzles, 5) using drift control additives, and 6) using sprayer shields (Hofman and Solseng 2001). Additionally, several university extension service agencies provide assistance regarding SOPs to minimize herbicide spray drift (Dexter 1993, Hofman and Solseng 2001).

Topography, Geology, Minerals, Oil, and Gas

The diversity in the landscape of the treatment areas reflects differences in geologic processes and the effects of climate, which have been shaping the land over a long period of time.

A detailed baseline summary of mineral, oil, and gas resources located within the project area, by ecoregion, is presented in the 2007 PEIS (BLM 2007a:3-6 to 3-7). Map 3-3 presents an update, based on the most recent available digital data, of oil and gas wells on public lands.

In 2011, conventional energy development from public lands produced 43 percent of the nation's coal, 13 percent of domestic natural gas, and 5 percent of the domestically produced oil. BLM-administered federal coal leases power more than 20 percent of the energy generated in the United States. The BLM is also actively promoting solar, wind, and geothermal energy development on federal lands. Nearly 40 percent of U.S. geothermal energy production capacity is on public lands (USDOI BLM 2012b).

At the end of Fiscal Year (FY) 2012, the BLM administered approximately 47,000 oil and gas leases, of which approximately 23,000 were producing (USDOI BLM 2013b). During 2011, geothermal leases generated more than 4,600 gigawatts of electrical power, and accounted for more than 40 percent of the U.S. geothermal energy capacity (USDOI BLM 2013c).

States within the project area with the largest acreage of public lands in producing status for oil and gas activities are New Mexico, Colorado, Montana, and North Dakota. Between 2006 and 2012, there were substantial increases in the amount of public land in producing status in North Dakota and California, and sizeable decreases in Alaska and Nevada (USDOI BLM 2013a). Coal licenses and leases occur on public lands in Colorado, Montana, New Mexico, Oklahoma, Utah, and Wyoming. Mining operations occur on public lands in the majority of the western states covered by this PEIS, with most mining activity occurring in Nevada. Geothermal potential exists in 12 of the 17 states covered by this PEIS.

Soil Resources

Soils in the treatment area are diverse and range from the arid, saline soils of the Southwest, to the clayey glaciated soils of Montana, to the cold, wet permafrost soils of Alaska.

Eleven soil orders are represented on public lands in the western U.S. and Alaska (Map 3-4). Because soils develop under local conditions of climate, parent material, and vegetation, each ecoregion may contain several or all of the soil orders as a result of various combinations of local soil forming factors. A detailed description of soils by soil order is presented in the 2007 PEIS (USDOI BLM 2007a:3-7 to 3-9) and is incorporated here by reference. Map 3-4 is a very basic inventory of soil types at the landscape level. More detailed mapping of soils and associated information can be found in individual soil surveys completed for

the western U.S., which are available on-line at <http://www.nrcs.usda.gov/wps/portal/nrcs/soilsurvey/soils/survey/state/>.

The concept of soil quality encompasses a soil's capacity to function. Healthy soils support plant and animal diversity and productivity, air and water quality, and human health (Soil Quality Institute 2001). They filter and buffer pollutants, store and cycle nutrients, and support structures and protect archaeological resources. Soil quality is a function of each soil's inherited properties (texture, type of minerals, and depth), as well as more dynamic properties that can change with management (porosity, infiltration, effective ground cover, and aggregate stability). The ability of a soil to filter, buffer, degrade, immobilize, and detoxify herbicides is a function of the soil quality.

Soil quality is integrated with the BLM's management activities, which can result in changes in certain soil properties such as soil porosity, organic matter, biological activity, and susceptibility to erosion. These changes in turn affect the fate of herbicides in soils. For example, disturbances that result in increased susceptibility to erosion will affect the off-site movement of certain herbicides that are designed to bind to soil particles. Herbicides can alter soil organism diversity and composition. Compaction or surface disturbance may affect soil-activated herbicides from reaching the root zone of target plants. Soil quality is also considered by the BLM in health score cards used to assess land health.

Biological Soil Crusts

Biological soil crusts (also known as cryptogamic, microbiotic, cryptobiotic, or microphytic crusts) are commonly found in semiarid and arid environments. They are a community of organism at the surface of the soil comprised of cyanobacteria, blue-green algae, microfungi, mosses, liverworts, and lichens (Rosentreter et al. 2007). Biological soil crusts provide important functions, such as improving soil stability and reducing erosion, fixing atmospheric nitrogen and contributing nutrients to plants, and assisting with plant growth (Belnap and Gardner 1993, Evans and Ehleringer 1993, Eldridge and Greene 1994, Belnap and Gillette 1998, Harper and Belnap 2001). They also enhance soil fertility and stability. Biological soil crusts occupy open spaces between the sparse vegetation of the Great Basin, Colorado Plateau, Sonoran Desert, and the inner Columbia Basin, and also occur in agricultural areas and native prairies, and in Alaska.

Biological soil crusts can reach up to several inches in thickness and vary in terms of color, surface topography, and surficial coverage. Crusts generally cover all soil spaces not occupied by vascular plants, which may be 70 percent or more in arid regions (Belnap 1994). They are well-adapted to severe growing conditions, but are influenced by disturbances such as compression from domestic livestock grazing, tourist activities (hiking, biking, and OHVs), mechanical treatment and agricultural practices (extensive tillage and planting), application of herbicides, and military activities (Peterjohn and Schlesinger 1990, Belnap 1995, U.S. Geological Survey [USGS] 2004). It is prudent to minimize surface disturbance of soil crusts to prevent invasions of annual fire-adapted grasses and minimize dust produced from disturbance.

Micro and Macroorganisms

The soil microbial community plays a crucial role in maintaining ecosystem health and sustainability, with plant-microbe interactions contributing to the condition of the ecosystem. Microorganisms help to break down and convert organic remains into forms that can be used by plants. Microorganisms, such as mycorrhizal fungi, nitrogen-fixing organisms, and certain types of bacteria assist plant growth, suppress plant pathogens, and build soil structure. There is evidence that certain bacteria in soil may suppress cheatgrass and other invasive species (USFWS 2013). One of the main benefits of mycorrhizal fungi is the improved uptake of nutrients (predominantly phosphorous) and water by plants (Allen 1991). Soil microorganisms are also important in the breakdown of certain types of herbicides.

Macroorganisms, such as insects, earthworms, and small burrowing mammals, mix the soil and allow organic matter on the surface to become incorporated into the soil. These organisms are part of a food web that is essential to the cycling of nutrients within the soil. Soil organisms interact and support plant health as they decompose organic matter, cycle nutrients, enhance soil structure, and control the populations of soil organisms, including pests (Ingham, no date).

Soil Erosion

Soil erosion is a concern throughout the western U.S. and Alaska, particularly in semiarid rangelands. The quantity of soil lost by water or wind erosion is influenced by climate, topography, soil properties, vegetative cover, and land use. While erosion occurs under natural conditions, rates of soil loss may be

accelerated if human activities are not carefully managed.

Tundra lands in Alaska are susceptible to erosion if the thick vegetative mat overlying permafrost is disturbed or removed. Trails quickly turn into widely braided ruts, especially in wetlands and at streambank crossings. The resulting gully erosion can rapidly erode substantial quantities of previously frozen soils. Erosion from aufeis (thick ice that builds up as a result of repeated overflow) and anchor ice is also a concern, because of spring breakup flood events leaving disturbed stream channels. These events cause previously stable riparian areas to form a long-lasting sequence of extensively braided channels, especially in glacial soils.

Rangelands are affected by all four types of water erosion: sheet, rill, gully, and streambank. Sheet erosion is relatively uniform erosion from the entire soil surface and is therefore often difficult to observe, while rill erosion is initiated when water concentrates in small channels as it runs off the soil. Sheet and rill erosion are capable of reducing the productivity of rangeland soils, but often go unnoticed. Gully and streambank erosion is far more visible, and may account for up to 75 percent of erosion in desert ecosystems (Hein 2002).

Wind erosion is most common in arid and semiarid regions where lack of soil moisture greatly reduces the adhesive capability of soil (Brady and Weil 2002). Most wind erosion problems result from bare, exposed soils with weak or degraded soil structure, such as along trails or on sand dunes or disturbed surfaces. In addition to moisture content, soil particle size (texture), mechanical stability of aggregates and clods, and presence of vegetation also affect the ability of wind to move soil.

It is possible to control rates of soil erosion by managing vegetation, plant residues, and soil disturbance. Vegetative cover is the most significant factor in controlling erosion because it intercepts precipitation, reduces rainfall impact, restricts overland flow, and improves infiltration. Biological soil crusts are particularly important for protecting the soil and controlling erosion in desert regions, but are easily disturbed by grazing and human activities. While wind erosion on rangelands is difficult to quantify, the presence of natural vegetation on most rangelands is generally sufficient to keep wind erosion from becoming a serious problem.

In areas treated with herbicides, erosion can lead to movement of herbicides on soil particles. Herbicides

bound to soil particles may be moved off site by wind or water erosion events. Soil texture (sand, silt, and clay) and structure affect the movement of water and herbicides through soil, and the amount of herbicide that is likely to be adsorbed by soil. The coarser the soil, the faster the movement of percolating water and the lower the opportunity for adsorption of dissolved chemicals. Soils with more clay and organic matter tend to hold water and dissolved chemicals longer. These soils also have far more surface area onto which herbicides can be adsorbed (LaPrade 1992).

Soil Disturbance

Many western landscapes with undisturbed soils are healthy, stable, and less vulnerable to erosion than areas with disturbed soils. Soil disturbance stimulates erosion, breaks up soil aggregates, and promotes the loss of organic matter.

Soil compaction occurs when moist or wet soil aggregates are pressed together and the pore space between them is reduced. Compaction changes soil structure, reduces the size and continuity of pores, and increases soil density. Large animals, vehicles, and people can cause soil compaction. Generally, soil made up of particles of about the same size compacts less than soil with a variety of particle sizes. Numerous rock fragments can create bridges that reduce compaction. Plant litter and roots, and soil organic matter, structure, moisture, and texture all affect a soil's ability to resist compaction. In areas of rangeland where compaction exists, compacted soil extends generally less than 6 inches below the soil surface, although it can be as deep as 2 feet under heavily used tracks and roads (USDA Natural Resources Conservation Service 1996). Compaction becomes a problem when the increased soil density limits water infiltration, increases runoff and erosion, or limits plant growth or nutrient cycling (Soil Quality Institute 2001).

Water Resources and Quality

Water Resources

Water resources in the western U.S. and Alaska are important for fish and wildlife habitat and a variety of human needs, such as domestic consumption, industrial activities, crop irrigation, livestock watering, and recreation. Numerous legal and policy requirements have been established to manage water resources for these multiple needs, including state law and case law defining water rights, the Clean Water Act, the

Colorado River Basin Salinity Control Act, and EO 11988 (*Floodplain Management*).

Water resources are classified as surface water or groundwater. Surface water resources include rivers, streams, lakes, ponds, reservoirs, and wetlands. Major river systems (e.g., Colorado, Columbia, Snake, Missouri, Arkansas, Rio Grande, and Yukon Rivers) and their tributaries are important sources of water in the western U.S and Alaska. Additional discussion of surface water and groundwater resources can be found in the 2007 PEIS (USDOI BLM 2007a:3-15).

As shown on Map 3-5, nine hydrologic regions have been identified in the treatment area: Alaska, Pacific Northwest, California, Upper Colorado, Lower Colorado, Rio Grande, Missouri, Great Basin, and Arkansas-White-Red (Seaber et al. 1987). Most public lands occur in arid to semiarid environments in the Great Basin and Colorado drainage basins. A discussion of these hydrologic regions and their main hydrologic resources is included in the 2007 PEIS (USDOI BLM 2007a:3-11 to 3-15), and is incorporated here by reference.

Groundwaters are more complex than surface waters in that they occur in aquifers that are beyond our sight, can have rapid or extremely slow flow rates, and can recharge or discharge from streams and uplands or alternate between discharging and recharging, depending on a multitude of factors. Groundwaters or aquifers can also become contaminated and can transport contaminants over great distances very rapidly or over thousands of years. Once contaminated, aquifers can also be very difficult to cleanse, either naturally or by remediation. Very shallow aquifers can release contaminants over a matter of days, while very deep aquifers with long flowpaths can take thousands of years to flush, possibly longer if contaminants become bound in the strata.

As populations in the western U.S. increase, water availability has become a concern, particularly during drought conditions. In the Southwest, in particular, ongoing extraction of water from groundwater storage is resulting in depleted aquifers. Additionally, use of surface water is resulting in reduced flows in some streams and rivers. Finally, there is evidence that climate change is resulting in a shift in patterns of precipitation, which could further exacerbate water availability issues in certain areas (USGS 2005a).

Water Quality

Water quality is defined in relation to its specified and/or beneficial uses, such as human consumption, irrigation, fisheries, livestock, industry, or recreation. The quality of surface water is determined by interactions with soil, transported solids (organics and sediments), rocks, groundwater, and the atmosphere.

The BLM has responsibilities to protect water quality in accordance with mandates of the FLPMA and the Clean Water Act, as well as other laws and regulations that pertain to water quality. The BLM cooperates with the USEPA, states, and tribes to meet water quality standards. The BLM must maintain waters for designated beneficial uses, restore impaired water resources in support of their designated beneficial uses, and provide water for public consumption and use (USEPA 2013a).

Section 303(d) of the Clean Water Act requires that water bodies violating state water quality standards and failing to protect beneficial uses be identified and placed on a 303(d) list (USEPA 2013a). The delisting of 303(d) listed streams is a priority of the BLM.

Nonpoint source pollution, the largest source of water quality problems, comes from diffuse or scattered sources rather than from an outlet, such as a pipe that constitutes a point source. Sediment is a nonpoint source of pollution that results from activities such as livestock grazing and timber harvest. Erosion and delivery of eroded soil to streams is the primary nonpoint source pollution problem of concern to the BLM (USDOI BLM 1980).

Additional discussion of water quality pollutants, and a summary of baseline water quality information for water resources in each hydrologic region, are provided in the 2007 PEIS (USDOI BLM 2007a:3-15 to 3-18, Maps 3-6 and 3-7).

In the western U.S., the key water quality issues limiting water usability are the presence of elevated concentrations of naturally occurring constituents (such as dissolved minerals and trace elements such as arsenic), irrigation return flows, mining, and urbanization. Increased salinity in deep aquifers and some surface water bodies in the arid West have made them unsuitable sources of drinking water (USGS 2005a).

Irrigation return flows may contain salts, trace elements, and agrochemicals such as nitrate and pesticides. In certain areas, irrigation water may be reused multiple times, resulting in elevated levels of contaminants such as selenium, boron, arsenic, mercury, and pesticides (USGS 2005a). Herbicides can impact the quality of both surface water and groundwater. Herbicide use in agricultural areas accounts for approximately 70 percent of the total national use of pesticides, and has resulted in the widespread occurrence of these chemicals in agricultural streams and shallow groundwater (USGS 1999).

Abandoned, inactive, and active mines can release highly acidic and toxic mine drainage that contains elevated levels of trace elements. These elements may also be leached from exposed mine deposits (USGS 2005a).

Urbanization of many areas of the western U.S. has resulted in increased wastewater return flows, as well as increased stormwater runoff from developed areas. Municipal treated wastewater may contain residual herbicides and other pesticides, industrial and household chemicals, and pharmaceuticals. Urban streams also contain elevated concentrations of pesticides used at residences, commercial areas, and public areas (USGS 2005a).

The most recent water quality inventories available are the 2004 National Water Quality inventory (USEPA 2009a) for surface water, and the USGS National Water Quality Assessment (USGS 2002 to 2012) for groundwater. Based on the 2004 inventory, 45 percent of stream miles in the western U.S. are in good biological condition, compared to best-available reference sites, 26 percent are in fair condition, and 28 percent are in poor condition. The most prevalent stressors observed were nitrogen, phosphorus, riparian disturbance, and streambed sediments. Nationwide, the top sources of stream impairment were agricultural activities, hydromodifications (e.g., water diversions, channelization, and dam construction), and unknown or unspecified sources.

Based on the most recent Alaska Water Quality Assessment Report (USEPA 2010b), approximately 30 percent of inventoried river and stream miles are classified as good waters, while approximately 70 percent are classified as impaired waters. The primary causes of impairment are turbidity, fecal coliform, and sedimentation/siltation, with resource extraction and urban runoff/stormwater as the primary sources of impairment.

The USGS National Water Quality Assessment (NAWQA) assesses trends in concentrations of chloride, dissolved solids, and nitrate (USGS 2012). In sampled wells in the western U.S., these pollutants show increasing trends in some areas, relatively stable trends in other areas, and decreasing trends in others. Throughout much of the Great Basin, there is a stable overall trend, with pollutants increasing in some sampled wells but decreasing in others. In California's Central Valley, there is an increasing trend in all three pollutants. In the Subtropical Desert Ecoregion there is an increasing trend in chloride in the Rio Grande Valley of New Mexico, and an increasing trend in dissolved solids in the Rio Grande Valley and Central Arizona basins. Dissolved solid concentrations are also increasing in the Central Columbia Plateau of Washington. In the upper Snake River Basin of Idaho, chloride is increasing but nitrates are decreasing. One other area showing a trend of improvement is the Willamette Basin of Oregon, where nitrate concentrations in groundwater are decreasing.

Pesticides have been detected in streams and groundwater in the western U.S., and are most prevalent in areas with substantial agricultural or urban land uses. The NAWQA has been assessing surface water and groundwater quality since 1991. According to the NAWQA, pesticides are more frequently detected in streams than in groundwater, and more frequently in shallow wells than in deeper wells that tap aquifers. The most commonly detected herbicides in sampled streams, nationwide, include commonly used agricultural herbicides and five herbicides used for nonagricultural purposes, including three currently used by the BLM (2,4-D, diuron, and tebuthiuron; USGS 2006). In groundwater, compounds with relatively high mobility and persistence have been detected most commonly, none of which are currently used by the BLM in its vegetation management programs.

Wetland and Riparian Areas

Wetlands are generally defined as areas inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support vegetation that is typically adapted for life in saturated soil. Wetlands include bogs, marshes, shallows, muskegs, wet meadows, estuaries, and riparian areas. The BLM administers approximately 12.9 million acres of wetlands. Of these, approximately 12.6 million acres are found in Alaska (USDOI BLM 2012a).

Riparian and wetland areas comprise approximately 5 percent of BLM lands (USDOI BLM 2012a). The benefits of these vital areas, however, far exceed their relatively small acreage. The functions of wetland and riparian areas include water purification, stream shading, flood attenuation, shoreline stabilization, groundwater recharge, and habitat for aquatic, semiaquatic, and terrestrial plants and animals (USEPA 2005a).

The BLM defines properly functioning wetlands as those that: 1) support adequate vegetation, landform, or debris to dissipate energies associated with wind action, wave action, and overland flow from adjacent sites, thereby reducing erosion and improving water quality; 2) filter sediment and aid floodplain development; 3) improve floodwater retention and groundwater recharge; 4) develop root masses that stabilize islands and shoreline features against cutting action; 5) restrict water percolation; 6) develop diverse ponding characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterbird breeding, and other uses; and 7) support greater biodiversity (Prichard et al. 2003). This assessment does not take into consideration the habitat value of the wetland to fish and wildlife. It also does not directly consider the presence of invasive plant species, although it does assess vegetation characteristics that can be altered by invasive species, such as structural characteristics, age-class distribution, and species diversity.

Ninety-eight percent of wetlands located on BLM land are thought to be functioning properly. In Alaska, 99 percent of wetlands are considered to be in proper functioning condition, in terms of their ability to dissipate energy associated with high-flow events, with the status of the remaining 1 percent unknown. Within the lower 48 states, approximately 58 percent of wetlands are considered to be in proper functioning condition. Approximately 2 percent are considered to be non-functional, 42 percent are functioning at risk, and 26 percent are unknown. Public lands with poorly functioning wetlands tend to be located in the southwestern U.S. For example, 15 percent of the wetland acres in New Mexico and 14 percent of the wetland acres in Arizona are considered non-functional (USDOI BLM 2012a).

Riparian areas, according to the BLM, are green zones along flowing-water features such as rivers, streams, and creeks (Gebhardt et al. 1990). The BLM administers approximately 155,300 miles of riparian habitat in the treatment area. Of this, approximately

107,600 miles are found in Alaska (USDOI BLM 2012a).

It is estimated by the BLM that 42 percent of surveyed riparian areas in the lower 48 states and 100 percent of riparian areas in Alaska are properly functioning, in terms of having adequate vegetation, landform, or large woody debris present to dissipate stream energy associated with high water flows (USDOI BLM 2012a). Two percent of riparian areas in the lower 48 states are considered non-functional, and 14 percent are functioning but at risk (USDOI BLM 2012a). Poorest functioning riparian areas are found in the Southwest, while most riparian areas in Alaska, Colorado, Montana, and Utah function properly.

Vegetation

The composition and distribution of plant communities in the western U.S. have been influenced by many factors, including climate, drought, insects, diseases, wind, domestic livestock grazing, cultivation, browsing by wildlife, and fire (Gruell 1983). Other activities that have an effect on plant communities include development, agricultural production, logging, mineral extraction, reclamation activities, recreational activities, and ROW development including road construction and maintenance. In addition, non-native plant species have invaded native plant communities, resulting in the loss of ecosystem components in portions of the western U.S.

Before European settlement, naturally occurring fire was an important influence on the landscape of the western U.S., and plant communities were adapted to the occasional intense fires that burned over the landscape (Gruell 1983). The exclusion of fire following European settlement has caused significant changes in plant species composition in the western U.S., especially in areas adapted to fire (Swetnam 1990). Where fire-adapted communities previously limited the expansion of pinyon, juniper, and other less fire-tolerant species, exclusion of fire has resulted in expansion of these species into the surrounding ecosystems (Gruell 1983). The circumstance has also contributed to accumulation of hazardous fuels. In rangelands, many vegetation types have altered fire regimes and are experiencing more frequent fires that burn larger, more continuous areas, which has contributed to the expansion of invasive grasses and forbs. Invasive annual grasses have increased the incidence of fires in sagebrush communities adapted to infrequent fires, and have reduce the fire return

frequency to such an extent that portions of sagebrush steppe have been converted to grassland.

Vegetation Classification System

In the 2007 PEIS, vegetation within the treatment area was classified into 14 subclasses, consistent with the 1997 National Vegetation Classification Standard (see USDOI BLM 2007a:3-19, Table 3-4). This standard differentiated vegetation on the basis of growth form, life history strategy, and percent of canopy closure or hydrologic influences (Federal Geographic Data Committee 1997), with important subclasses then described by ecoregion (USDOI BLM 2007a:3-19 to 3-25).

In 2008, a new, dynamic standard was adopted (Federal Geographic Data Committee 2008), which the BLM is currently using for all Resource Management Plans. The new standard classifies vegetation based on floristic (species-based) and physiognomic (growth form-based) properties. Table 3-4 summarizes important macrogroups within likely BLM vegetation treatment areas, as well as their associated classes, subclasses, formations, and divisions. The majority of future vegetation treatments are likely to occur within these macrogroups. A complete list of macrogroups within the 17-states analysis area is provided in Appendix D, along with brief descriptions of key macrogroups by ecoregion.

As shown in Table 3-4, the new classification incorporates climate and geographic location into its hierarchy. Original vegetation descriptions in the 2007 PEIS considered ecoregion as well as vegetation classifications. For the sake of clarity and consistency, this PEIS will follow a similar approach to the earlier PEIS for assessing impacts to vegetation. However, the new classification system groupings will be introduced into the analysis as appropriate.

Based on the BLM's past vegetation treatment activities, and future vegetation treatment goals, the following macrogroups, by ecoregion, are the most likely locations of future herbicide treatments. Additional descriptions of vegetation within each ecoregion can be found in the 2007 PEIS (USDOI BLM 2007a:3-19 to 3-25).

Tundra and Subarctic Ecoregions

Only very limited herbicide treatments are currently proposed for macrogroups within these ecoregions, but more may occur in them in the future. Regardless, the

vegetation macrogroups in this ecoregion are unlikely to constitute more than a small fraction of the areas receiving herbicide treatments.

Temperate Desert Ecoregion

The Temperate Desert Ecoregion includes the arid shrublands and grasslands of the Great Basin and the Rocky Mountains, as well as lower montane forests and pinyon-juniper woodlands.

As far as locations of likely future herbicide treatments, important macrogroups that occur in the Temperate Desert Ecoregion include shrublands, grasslands, and sagebrush shrubland and steppe. Rocky Mountain and intermountain forests and woodlands are also important, to a lesser degree.

Great Basin and Intermountain Dry Shrubland and Grassland

The shrubland-steppe and grasslands in this macrogroup occur throughout the Colorado Plateau and Arizona-New Mexico Mountains, west to the Mojave Desert, and north to the Wyoming Basin. The shrubland-steppe is either shrub-dominated, dwarf shrub-dominated, or grass-dominated with a sparse shrub layer. The grasslands are located throughout the intermountain western U.S., as a matrix over large areas of intermountain basins and in mosaics with semi-desert shrublands. The dominant perennial bunchgrasses and shrubs of these grasslands are drought-resistant.

Great Basin and Intermountain Tall Sagebrush Shrubland and Steppe

This macrogroup consists of shrublands and shrub-steppe that are widely distributed from the Great Basin, Columbia River Basin, Colorado Plateau, northern Rocky Mountains, and northwestern Great Plains, as far east as the Dakotas. Climate ranges from arid to subhumid. Stands are dominated by Wyoming big sagebrush and basin big sagebrush, sometimes along with other shrub species. The herbaceous layer can be sparse to strongly dominated by graminoids.

Northern Rocky Mountain-Vancouverian Montane and Foothill Grassland and Shrubland

This macrogroup is comprised of shrublands in the lower montane and foothill regions around the Columbia Basin and north and east into the Northern Rocky Mountains, and dry grasslands occurring in the canyons and valleys of the northern Great Basin and Columbia

TABLE 3-4
Vegetation Classification System

Formation Class	Formation Subclass	Formation	Division	Macrogroup
Forest and Woodland	Temperate Forest	Warm Temperate Forest	Southwestern North American Warm Temperate Forest	California Forest and Woodland
				Californian-Vancouverian Foothill and Valley Forest and Woodland
				Madrean Warm Montane Forest and Woodland
			Southwestern North American Warm Temperate Scrub and Woodland	Southern Plains Scrub Woodland and Shrubland
		Cool Temperate Forest	Western North American Cool Temperate Forest	Southern Vancouverian Montane and Foothill Forest
				Vancouverian Lowland and Montane Rainforest
				Northern Rocky Mountain Lower Montane and Foothill Forest
				Southern Rocky Mountain Lower Montane Forest
			Western North American Cool Temperate Woodland and Scrub	Intermountain Singleleaf Pinyon-Western Juniper Woodland
				Rocky Mountain Two-Needle Pinyon-Juniper Woodland
Shrubland and Grassland	Mediterranean Scrub and Grassland	Mediterranean Scrub	California Scrub	California Chaparral
		Mediterranean Grassland and Forb Meadow	California Grassland and Meadow	California Annual and Perennial Grassland
				California Ruderal Grassland and Meadow

**TABLE 3-4 (Cont.)
Vegetation Classification System**

Formation Class	Formation Subclass	Formation	Division	Macrogroup
Shrubland and Grassland (cont.)	Temperate and Boreal Shrubland and Grassland	Temperate Grassland, Meadow and Shrubland	Western North American Grassland and Shrubland	Northern Rocky Mountain-Vancouverian Montane and Foothill Grassland and Shrubland
				Southern Rocky Mountain Montane Grassland and Shrubland
				Southern Vancouverian Lowland Grassland and Shrubland
			Great Plains Grassland and Shrubland	Great Plains Mixedgrass Prairie and Shrubland
				Great Plains Shortgrass Prairie and Shrubland
			Western North American Interior Sclerophyllous Chaparral Shrubland	Cool Interior Chaparral
				Warm Interior Chaparral
Semi-Desert	Warm Semi-Desert Scrub and Grassland	Warm Semi-Desert Scrub and Grassland	North American Warm Desert Scrub and Grassland	Apacherian-Chihuahuan Semi-Desert Grassland and Steppe
	Cool Semi-Desert Scrub and Grassland	Cool Semi-Desert Scrub and Grassland	Western North American Cool Semi-Desert Scrub and Grassland	Chihuahuan Desert Scrub
				Great Basin and Intermountain Dry Shrubland and Grassland
				Great Basin and Intermountain Tall Sagebrush Shrubland and Steppe

Source: Developed by the BLM based on the Federal Geographic Data Committee Vegetation Subcommittee's National Vegetation Classification Standard, Version 2 (Federal Geographic Data Committee 2008).

Note: This table shows the important vegetation macrogroups. Vegetation treatments may occur in additional macrogroups not shown here (see Appendix D), which comprise a substantially smaller proportion of the proposed treatment acres.

Basin. The shrublands occur within a matrix of low-elevation grasslands and sagebrush shrublands. The grasslands consist of patchy graminoid cover, cacti, and some forbs.

Southern Rocky Mountain Montane Grassland and Shrubland

The shrublands in this macrogroup are dominated by Utah serviceberry, alderleaf mountain mahogany, or Gambel oak. The macrogroup extends from the southern and central Great Plains, southwest to southern New Mexico, extending north into Wyoming, and west into the Intermountain West region.

Northern Rocky Mountain Lower Montane and Foothill Forest

The ponderosa pine woodlands and “wooded steppes” in this macrogroup are located in the foothills of the northern Rocky Mountains in the Columbia Plateau region and west along the foothills of the Modoc Plateau and Eastern Cascades into southern interior British Columbia, and east across Idaho into the eastern foothills of the Rocky Mountains. The woodlands and wooded steppes occur at the lower treeline/ecotone between grasslands or shrublands and more moist coniferous forests, typically on warm, dry, exposed sites. The macrogroup also includes ponderosa pine woodlands that occur along the eastern face of the Rocky Mountains and into the Great Plains.

Southern Rocky Mountain Lower Montane Forest

This macrogroup consists of forests dominated by ponderosa pine, either solely or mixed with other coniferous species. Mixed forests typically have a shrub understory, while forests dominated solely by ponderosa pine typically have a grass-dominated understory.

Intermountain Singleleaf Pinyon-Western Juniper Woodland

This macrogroup consists of pinyon-juniper woodlands that occur on dry mountain ranges of the Great Basin and eastern foothills of the Sierra Nevada. They are dominated by singleleaf pinyon, Utah juniper, or western juniper. This macrogroup includes woodlands that have expanded from their historical ranges into grasslands, steppe, and shrub-steppe habitats, primarily as a result of fire exclusion and livestock grazing.

Rocky Mountain Two-Needle Pinyon-Juniper Woodland

This macrogroup includes pinyon-juniper woodlands that occur on dry mountains and foothills of the Colorado Plateau region, along the east and south foothill slopes of the southern Rocky Mountains and into the plains of southeastern Colorado and northern central New Mexico, on dry mountains and foothills in southern Colorado east of the Continental Divide, and in mountains and plateaus of northern and central New Mexico. Dominant species include two-needle pinyon, Utah juniper, or oneseed juniper. This macrogroup includes some woodlands that have expanded into adjacent grasslands and become denser.

Temperate Steppe Ecoregion

The Temperate Steppe Ecoregion occurs in a semiarid continental climate zone, and includes the Rocky Mountains and the Great Plains. Most of the important macrogroups in this ecoregion also occur in the Temperate Desert Ecoregion and were described in the previous subsection. They include many of the Rocky Mountain grassland, shrubland, and forest, and pinyon-juniper woodland macrogroups listed in Table 3-4 (see Appendix D). Additionally, they include the grassland and shrubland macrogroups of the Great Plains.

Great Plains Mixedgrass Prairie and Shrubland

This macrogroup consists of mesic and dry mixed grass prairies of the Great Plains. On mesic sites they are a mixture of mostly mixed grass prairie with some tallgrass prairie. Graminoids such as western wheatgrass, green needlegrass, big bluestem, and Idaho fescue are dominant. With intensive grazing, cool-season non-native species such as Kentucky bluegrass, smooth brome, and field brome can increase in dominance. Shrub species can increase in dominance with fire suppression. The dry mixed grass prairies occur on flat to rolling topography, and are dominated by moderate to moderately dense medium-tall grasses and scattered shrub.

Great Plains Shortgrass Prairie and Shrubland

This macrogroup includes shortgrass prairies dominated by blue grama and buffalograss, and shrublands dominated by honey mesquite. They occur on flat to rolling uplands, and are characterized by a moderate to

dense sod of short grasses, with scattered mid grasses and forbs. The shortgrass prairies occur in the rain shadow of the Rocky Mountains and range from the Nebraska Panhandle south into Texas and New Mexico. The shrublands occur primarily in Texas, Oklahoma, and eastern New Mexico.

Subtropical Steppe

The Subtropical Steppe Ecoregion includes the plateaus and high plains of northern Arizona, New Mexico, and Texas. It supports a semiarid climate, and consists of primarily perennial grassland communities, with some shrublands and woodlands. Macrogroups that are most likely to be targeted by vegetation treatments are Warm Interior Chaparral, Rocky Mountain Two-Needle Pinyon-Juniper Woodland, and Chihuahuan Desert Scrub.

Warm Interior Chaparral

This macrogroup occurs in the northern Chihuahuan Desert and adjacent Sky Islands and Sonoran Desert, extending into limited areas of the southern Great Plains. Vegetation consists of moderately dense to dense grasslands, sometimes with scattered shrubs or succulents.

Rocky Mountain Two-Needle Pinyon-Juniper Woodland

These woodlands have two-needle pinyon, Utah juniper, or oneseed juniper as the dominant species. Within the subtropical steppe ecoregion they occur in mountains and plateaus of northern and central New Mexico.

Chihuahuan Desert Scrub

The Chihuahuan Desert shrublands are concentrated in the extensive desert grassland in foothills and piedmonts of the Chihuahuan Desert, extending into the Sky Island region to the west. Areas occupied by this macrogroup generally saw a shift from the original perennial grasslands to shrub-dominated communities. Possible causes of the shift include livestock grazing, climatic change, and fire suppression. Vegetation consists of desert scrub species, with honey mesquite or velvet mesquite and succulents as dominants.

Subtropical Desert

The Subtropical Desert Ecoregion occupies southeast California, southern Nevada, Arizona, New Mexico, and western Texas, and includes the Chihuahuan,

Sonoran, and Mojave Deserts. Vegetation is adapted to dry conditions, and includes numerous xerophytic plants. Since only a small fraction of the BLM's herbicide treatments occur in this ecoregion, no discussion of individual macrogroups is presented here. This information can be found in Appendix D.

Mediterranean

The Mediterranean Ecoregion Division occupies most of California (excluding deserts in the southeastern portion of the state) and a portion of southern Oregon. It supports chaparral communities, coniferous forests, and oak woodlands, among other vegetation types. Based on the BLM's treatment program goals, important macrogroups in this ecoregion are certain forests and woodlands.

California Forest and Woodland

This macrogroup consists of savannas, woodlands, and forests dominated by Californian endemic oak and conifer species. These habitats occur almost entirely within California below 8,000 feet.

Californian-Vancouverian Foothill and Valley Forest and Woodland

These forests and woodlands occur along the Pacific Coast lowlands from southern California to southern British Columbia. They occur inland from the coast, in the dry interior lowland valleys, and are drought tolerant.

Southern Vancouverian Montane and Foothill Forest

The forests and woodlands of this macrogroup occur in the foothills and lower montane elevations of the southern Cascade and Klamath Mountains, the Modoc Plateau, and the Sierra Nevada, Peninsula, and Transverse Ranges. This macrogroup covers a broad range of elevations. It includes dry montane Jeffery pine-ponderosa pine woodlands, Sierran mixed conifer woodlands, and mixed conifer woodlands tolerant of serpentine soils, among others.

Marine

The Marine Ecoregion Division occupies the Cascade and Coast Ranges of western Washington and Oregon, and the coast mountains of southeastern Alaska, along the Pacific Coast. The mild, rainy climate produces conditions that are hospitable for dense forest

communities, which are characteristic of this region. Most treatments are in ROWs where the vegetation is managed in an early seral condition. Since only a small fraction of the BLM's herbicide treatments occur in this ecoregion, no discussion of individual macrogroups is presented here. This information can be found in Appendix D.

Noxious Weeds and other Invasive Vegetation

Invasive plants are non-native species that may cause physical or environmental damage or have other adverse effects on humans. Invasive plants include noxious weeds, which are designated by federal, state, or county government as injurious to public health, agriculture, recreation, wildlife, or property. Infestations of invasive plants are capable of degrading wildlife habitat; reducing plant and animal diversity; displacing many threatened and endangered species; and reducing opportunities for hunting, fishing, camping and other recreational activities; and may cost millions of dollars in treatments and loss of productivity to land owners. Besides ecological and economic costs, invasive plants can cause impacts to public safety. A few native species, such as junipers, exhibit similar behavior, contributing to hazardous fuels and reducing groundwater through evapotranspiration.

The 2007 PEIS discusses the traits of invasive plants and their mechanisms of invasion (USDOI BLM 2007a:3-26 to 3-27).

BLM Infestations

The estimated rate of weed spread on public lands is 4,300 acres per day (USDOI BLM 2012c). An estimate of weed spread on all western federal lands is 10 percent to 15 percent annually (Asher and Dewey 2005).

Table 3-5 shows gross estimates of acres of infestation of key invasive plant species targeted for treatment by the BLM. These estimates were compiled by the BLM from data provided by individual field offices during a 2014 inventory. Based on this inventory, total estimated acres of invasive plant infestations on public lands in the western U.S. states exceeds 79 million acres (more than 30 percent of total land acres). States with the largest infestations are Nevada, Oregon, Utah, and Idaho. The most prevalent invasive plant species are annual grasses, which represent nearly 70 percent of the

total infested areas. Other species/groups that occupy more than 100,000 acres include thistles, halogeton, knapweeds, woody species (Russian olive and tamarisk), mustards (hoary cress, perennial pepperweed, and Dyer's woad), leafy spurge, toadflaxes, and starthistles. The BLM treated approximately 260,000 to 436,000 acres of invasive plants using herbicides during 2006 through 2012. States with the greatest acreage treated during this time period were New Mexico, Idaho, Wyoming, Nevada, and Oregon.

Vegetation Condition and Fire Regimes

The fire regime condition class (FRCC) is used by the BLM to help describe common issues on public lands, such as altered disturbance regimes, invasive species, or highly altered plant communities. The FRCC classifies land based on the degree of departure from historical fire regimes.

The BLM currently uses the Fire Regime Condition Class Mapping Tool, Version 2.2.0, to determine and map FRCC on public lands. The FRCCs reflect the current conditions' departure from modeled reference conditions. Three FRCCs have been defined, as follows (National Interagency Fuels Technology Transfer 2010):

Condition Class 1 lands (approximately 58.9 million acres of public lands) are within the natural or historical range of variation, and risk of losing key components is low. Vegetation attributes (composition and structure) are intact and functioning.

Condition Class 2 lands (approximately 84.6 million acres) have fire regimes that have been moderately altered from their historical conditions. They experience either an increased or decreased fire frequency of one or more return intervals, potentially resulting in moderate changes in fire and vegetation attributes.

Condition Class 3 lands (approximately 82.6 million acres) have fire regimes that have been substantially altered, and the risk of losing key components to fire or other causes is high. Fire frequencies may have departed by multiple return intervals from historical fire regimes, potentially resulting in dramatic changes in fire size, intensity, and severity, as well as changes in landscape patterns. Vegetation attributes have been substantially altered.

TABLE 3-5
Estimated Acres of Invasive Plant Infestations on Public Lands in 2014

State	Annual ¹ Grasses	Halogeton	Knapweed Complex ²	Starthistles ³	Mustards ⁴	Leafy Spurge	Thistles ⁵	Toadflaxes ⁶	Woody Species ⁷	Total
Alaska	604	--	--	--	1	--	8	40	--	653
Arizona	1,009,649	29	10	319	18	--	5,528	--	2,326	1,017,879
California	4,395,500	25	5,012	15,097	255,071	1	13,112	313	347,108	5,031,239
Colorado	1,567,736	115,683	24,533	3	8,248	602	279,372	9,138	7,519	2,012,834
Idaho	5,373,002	45,805	1,435,775	11,451	40,800	242,500	162,651	8,915	17,425	7,338,324
Montana	231,979	1,120	149,839	--	6,135	124,859	348,217	233,620	978	1,096,747
Nevada	25,929,222	4,300,150	9,474	2,120	27,927	2,502	38,825	12	190,886	30,501,118
New Mexico	570,700	67,010	851	10,091	71	20	1,182	10	42,687	692,622
Oregon	6,602,000	1,000	261,520	105,000	404,000	1,000	13,020,710	2,000	104,000	20,501,230
Utah	7,596,812	2,664,244	13,580	6	2,458	300	13,290	10	384,367	10,675,067
Wyoming	285,343	1,308	12,104	--	4,833	24,117	24,856	647	15,158	368,366
Total	53,562,547	7,196,374	1,912,698	144,087	749,562	395,901	13,907,751	254,705	1,112,454	79,236,079

¹ Annual grasses include cheatgrass, red brome, buffelgrass, common Mediterranean grass, and medusahead rye.

² Knapweed complex includes Russian, spotted, diffuse, and squarrose knapweed.

³ Starthistles include Maltese and yellow starthistle.

⁴ Mustards include hoary cress, perennial pepperweed, and Dyer's woad.

⁵ Thistles include Canada, bull, plumeless, musk, Italian, and Scotch thistle.

⁶ Toadflaxes include dalmatian and yellow toadflax.

⁷ Woody species include Russian olive and tamarisk.

Note: North and South Dakota data are included in Montana data, Nebraska data are included in Wyoming data, Oklahoma and Texas data are included in New Mexico data, and Washington data are included in Oregon data.

Source: BLM 2014 invasive plant species inventory.

Map 3-6 shows the breakdown of FRCCs on public lands. Note that not all public lands fall into one of these categories. Based on Vegetation Condition Class data from Landfire (2010 and 2011), more than 58 percent (48 million acres) of the Condition Class 3 lands occur in the Temperate Desert Ecoregion, which is a substantial increase from the 21 million acres reported in the 2007 PEIS (USDOI BLM 2007a:3-29). Approximately 18 million acres (21.5 percent) of Condition Class 3 lands occur in the Subtropical Desert Ecoregion, which is a slight increase from the number reported in the 2007 PEIS. Condition Class 3 areas are less prevalent in the remaining ecoregions: 4.9 million acres occur in the Temperate Steppe Ecoregion, 3.2 million acres occur in the Subtropical Steppe Ecoregion, 3.1 million acres occur in the Subarctic Ecoregion, 3.0 million acres occur in the Tundra Ecoregion, 1.5 million acres occur in the Mediterranean Ecoregion, and 0.67 million acres occur in the Marine Ecoregion.

The fire regime group is another mapping tool utilized by the BLM that characterizes the presumed historical fire regimes within landscapes based on interactions between vegetation dynamics, fire spread, fire effects, and spatial context (Barrett et al. 2010). A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention (Agee 1993; Brown 1995 in Barrett et al. 2010). Five natural fire regime groups have been developed based on the average number of years between fires, combined with fire severity (Barrett et al. 2010):

Fire Regime Group I – 0 to 35 year frequency, low to mixed severity.

Fire Regime Group II – 0 to 35 year frequency, replacement severity.

Fire Regime Group III – 35 to 200 year frequency, low to mixed severity.

Fire Regime Group IV – 35 to 200 year frequency, replacement severity.

Fire Regime Group V – 200+ year frequency, any severity.

More fire is generally desired in groups I through III where fire was historically more frequent. In groups IV and V, too much fire has generally occurred on BLM lands and fire-adapted invasive plant species are prevalent.

Of the public lands categorized under the fire regime group classification, the majority (66 percent) are in group IV or V, with 44 percent in groups I through III. Most public lands where fire is occurring much more frequently than historically are found in the Temperate Steppe (45 percent) and Temperate Desert (30 percent) ecoregions.

Non-timber and Special Forest Products

Special forest products include plant materials, fungi, and bryophytes (mosses, liverworts, and hornworts). They consist of firewood, biomass, medicinal plants (e.g., ginseng and goldenseal), wild foods (e.g., mushrooms, berries, roots, and syrups), decoratives and floral greens (e.g., salal, ferns, and evergreen boughs), flavors and fragrances (e.g., sassafras and balsam fir), fibers (e.g., cedar bark, sweetgrass, and lichens), wild native seeds, and transplants for restoration and nursery stock. Special forest products are harvested for a variety of reasons, including subsistence, cultural, spiritual, commercial, recreational, and educational purposes.

During FY 2011, approximately \$270,000 worth of non-timber forest products were sold by the BLM in western states. The actual value of non-timber forest products harvested on public lands is substantially greater (USDOI BLM 2012a). Nearly half of non-timber forest product sales on public lands were in western Oregon, and about 18 percent were in Nevada. Other important states for non-timber forest product sales are Colorado and Utah.

Special Status Species

BLM special status species are: 1) species listed or proposed for listing under the ESA, and 2) species requiring special management consideration to promote their conservation and reduce the likelihood and need for future listing under the ESA. According to BLM policy, BLM actions must not adversely impact special status species. There are more than 150 plant species occurring on or near public lands in the treatment area that are federally listed as threatened or endangered, or proposed for listing. The number may change over time depending on future evaluations of each species' status. Special status plant species are distributed throughout the western U.S., including Alaska. A list of these species can be found in Appendix E.

For this PEIS, the BLM has consulted with the USFWS and NMFS on listed species and species proposed for listing, and their critical habitat, that could be affected by the proposed treatments. As part of the consultation process, the BLM prepared a BA, which provides a description of the distribution, life history, and current threats for each species (USDOI BLM 2015). Information contained in the BA will be used as a guideline by BLM field offices when developing local projects.

Fish and Other Aquatic Organisms

The BLM administers lands directly affecting almost 117,000 miles of fish-bearing streams and almost 3 million acres of reservoirs and natural lakes (USDOI BLM 2012b). These habitats range from isolated desert springs of the Southwest to large interior rivers and their numerous tributaries.

Key fish species that occur in aquatic habitats in or adjacent to BLM-administered lands are discussed in the 2007 PEIS, by geographic region (USDOI BLM 2007a:3-30 to 3-35).

Special Status Species

Nearly 80 aquatic animal species occurring on or near public lands are federally listed as threatened or endangered, or are proposed for future listing. Included in the total number are 61 species/subspecies of fish, 11 species of mollusk, and 7 aquatic arthropods. A complete list of these special status species can be found in Appendix E. Please note that this list is dynamic, and will likely change throughout the time period considered by this PEIS.

Special status aquatic animal species are found on public lands throughout the U.S. Numerous listed salmon populations are found in rivers of the Pacific Coast states. In arid areas, many special status fish species are found in the rare and fragile desert wetlands and springs, as well as in the major rivers such as the Colorado and the Rio Grande. In the deserts of the Great Basin and Colorado Plateau, terminal lakes, marshes, and sinks provide important habitat for special status fish species that are adapted to their warm, saline conditions.

Special status mollusks occur predominantly in the Snake River of Idaho, and in thermal habitats and small springs and wetlands in New Mexico, Arizona, and

Utah. Aquatic arthropods of special concern occur predominantly in the vernal pools of California.

Wildlife Resources

Public lands sustain an abundance and diversity of wildlife and wildlife habitat. Public lands provide a permanent or seasonal home for more than 3,000 species of amphibians, reptiles, birds, and mammals.

Wildlife populations are found in areas where their basic needs—food, shelter, water, reproduction, and movement—are met. The area in which the needs of a particular population are met is its habitat. Many animals have special behaviors and physical traits that allow them to successfully compete with other animals in only one or a few habitats; many threatened and endangered species fall into this category. Other animals, such as mule deer, coyote, and American robin are less specialized and can use a wider range of habitats.

Several features make some habitats better for wildlife than others. In turn, the more of these features that are present, the greater the diversity of wildlife species that are likely to be present. These features include:

- Structure – shape, height, density, and diversity of the vegetation and other general features of the terrain.
- Vertical layers – layers of vegetation (e.g., herbaceous, shrub, and forest canopy).
- Horizontal zones – vegetation and other habitat features that vary across an area.
- Complexity – an integration of vertical layers and horizontal zones.
- Edge – the area where two types of vegetative communities meet, such as a forest and shrub community.
- Special features – unique habitat features needed for survival or reproduction, including snags (dead trees), water, and rock outcrops.

For inventory and management purposes, the BLM divides wildlife habitat based on land cover types: Outside of Alaska, the vast majority of wildlife habitat is in the shrub-scrub category, with herbaceous and evergreen forest the next most abundant habitat types. In Alaska, dwarf shrub, shrub-scrub, evergreen forest,

and sedge/herbaceous are the most abundant habitat types (USDOI BLM 2012a).

The BLM inventories a portion of its rangelands. The BLM's Rangeland health standards include levels of physical and biological condition or degree of function required for healthy lands and sustainable uses, as defined in BLM Handbook H-4180-1 (*Rangeland Health Standards*; USDOI BLM 2001). Of lands that have been inventoried for rangeland health, 56 percent are rated as meeting standards for rangeland health or making significant progress toward meeting these standards. The remaining 44 percent of evaluated lands do not meet rangeland health standards, or are not making significant progress toward meeting the standards for various reasons. Livestock have been determined to be a significant factor affecting rangeland health on 29 percent of inventoried lands (BLM 2013d).

Based on a 2006 report, approximately 26 percent of BLM-administered lands are forested. The most common forest habitats are pinyon-juniper woodlands, juniper woodlands, and Douglas-fir forests (USDOI BLM 2006).

The BLM manages vegetation to improve wildlife habitat. Plants, which are an important component of habitat, provide food and cover. Food is a source of nutrients and energy, while cover reduces the loss of energy by providing shelter from extremes in wind and temperature, and also affords protection from predators. The important characteristics of wildlife and habitat in the eight ecoregions that comprise the treatment area are presented in the 2007 PEIS (USDOI BLM 2007a:3-36 to 3-43).

Special Status Species

There are 65 terrestrial animal species occurring on or near public lands in the treatment area that are federally listed as threatened or endangered, or proposed for listing. Included in the total number are 9 species of arthropod, 7 species of amphibian, 5 species of reptile, 16 species of bird, and 28 species of mammal. A complete list of special status animal species may be found in Appendix E. Please note that this list is dynamic, and will likely change throughout the time period considered by this PEIS.

Special status animal species are found on public lands throughout the U.S. Special status arthropods are largely butterflies that occur mostly in open habitats. Special status amphibians occur in wetland habitats throughout the West, and special status reptiles occur in warm

habitats of California and the Southwest. Special status birds and mammals use a wide range of habitats found on public lands throughout the western U.S.

Livestock

Approximately 155 million acres of public lands are available for livestock grazing. The majority of the grazing permits issued by the BLM involve grazing by cattle, with fewer and smaller grazing permits for other kinds of livestock (primarily sheep and horses).

The BLM administers grazing lands under 43 CFR Part 4100 and BLM Manual MS-4100 (*Grazing Administration – Exclusive of Alaska*; USDOI BLM 2009a). For management purposes, lands that are available for livestock grazing are divided into allotments and pastures. The BLM administers nearly 18,000 permits and leases for grazing on more than 21,000 allotments under BLM management. Permits and leases generally cover a 10-year period and are renewable if the BLM determines that the terms and conditions of the expiring permit or lease are being met. The grazing permit establishes the allotment(s) to be used, the total amount of use, the number and kind of livestock, and the season of use. The grazing permit may also contain terms and conditions as appropriate to achieve management and resource condition objectives. Allotment management plans further outline how livestock grazing is managed to meet multiple-use, sustained-yield, and other needs and objectives, as determined through land use plans.

Geographically specific rangeland health standards and guidelines are identified for each state to help direct the grazing program for those states. The BLM conducts reviews of land within its jurisdiction to determine the level of compliance with rangeland health standards. As of 2012, the BLM had inventoried approximately 126 million acres of rangeland. As stated previously, approximately 56 percent of inventoried rangelands are meeting all standards for rangeland health or making significant progress toward meeting these standards (BLM 2013d).

Public lands provide forage for many ranches and help to support the agricultural component of many communities scattered throughout the West. As of October 2011, the total number of grazing permits/leases in force was 17,694, with a total of 12.4 million Animal Use Months (AUMs) authorized (Table 3-6; USDOI BLM 2012a). There has been a gradual decrease in the amount of grazing on BLM-

administered lands, from 18.2 million AUMs in 1954 to 8.9 million AUMs in 2012 (USDOI BLM 2013e). In most years the actual use of forage is less than the amount authorized.

TABLE 3-6
Grazing Permits and Leases in Force and Active
Animal Unit Months in 2011

State	Leases and Permits	Active AUMs
Arizona	770	642,288
California	526	314,442
Colorado	1,471	584,901
Idaho	1,866	1,352,781
Montana	3,764	1,269,161
Nebraska	18	592
Nevada	684	2,120,374
New Mexico	2,272	1,847,960
North Dakota	79	9,279
Oklahoma	4	132
Oregon	1,231	1,023,040
South Dakota	472	73,223
Utah	1,452	1,190,920
Washington	265	33,073
Wyoming	2,820	1,925,583
Total	17,694	12,387,749
Source: BLM Public Land Statistics (USDOI BLM 2012a).		

Wild Horses and Burros

The BLM, in conjunction with the Forest Service, manages wild horses and burros on BLM- and Forest Service-administered lands through the *Wild Free-Roaming Horse and Burro Act of 1971*. As of June 2014, the free-roaming wild horse and burro population was approximately 49,200 animals, with another 48,000 animals held in holding pens (Table 3-7; USDOI BLM 2014a). The population of free-roaming wild horses and burros is nearly 22,500 animals above the Appropriate Management Level (AML) of 26,500. The AML is an estimate of the number of wild horses and burros that can graze on public lands without causing damage to the range.

Animals are managed within 179 wild horse and burro Herd Management Areas (HMAs; USDOI BLM 2012b). Wild horse herds grow at an average rate of 20 percent annually. Management is accomplished by carefully controlling horse and burro populations so that their numbers do not exceed the carrying capacity of the land. This is done primarily by gathering animals

periodically so that numbers are near the AML. Fertility control is being used in some HMAs as a means to reduce the population growth rate.

When horse and burro populations begin to exceed the AML, excess animals are gathered and offered to the public through periodic adoption. In FY 2011, 2,844 wild horses and burros were adopted in the U.S. Thirty-three percent of these were adopted in the eastern U.S. More than 227,000 animals have been adopted since 1971 (USDOI BLM 2012a). Public lands inhabited by wild horses or burros are closed to grazing under permit or lease by domestic horses and burros. The *Wild Free-Roaming Horse and Burro Act* of 1971 mandates that wild horses and burros can only be managed in areas where they were found in 1971. Those that stray onto non-designated public and/or private lands are removed.

Paleontological and Cultural Resources

Paleontological Resources

The BLM is responsible for managing public lands and their various resources so that they are utilized in a manner that will best meet the present and future needs of this Nation. The western U.S. has a fossil record that includes almost all of the geologic periods from the Cambrian (500+ million years ago) to the Holocene (Recent; from approximately 11,000 years before the present [BP]), and nearly every imaginable ancient environment. Many fossil deposits are of national and international importance. It is estimated that there are more than 50,000 fossil sites documented on public lands. More information on paleontological resources and their management is provided in the 2007 PEIS (USDOI BLM 2007a:3-45 and Table 3-8).

Cultural Resources

Cultural resources include archaeological, historic, or architectural sites, structures, or places with important public or scientific uses, and may include definite locations (sites or places) of traditional cultural or religious importance to specific social or cultural groups. The BLM locates, classifies, and ranks cultural resources, and manages them according to their relative importance, to protect significant cultural resources from inadvertent loss, destruction, or impairment, and to encourage and accommodate the appropriate uses of these resources through planning and public participation.

TABLE 3-7
Wild Horses and Burros on Public Lands in Fiscal Year 2013

State	Wild Horses	Wild Burros	Total	Maximum AML
Arizona	333	4,411	4,744	1,676
California	4,086	1,922	6,008	2,184
Colorado	1,205	0	1,205	812
Idaho	668	0	668	617
Montana, North Dakota, and South Dakota	160	0	160	120
Nevada	23,347	1,688	25,035	12,796
New Mexico, Oklahoma, and Texas	146	0	146	83
Oregon and Washington	3,120	60	3,180	2,715
Utah	3,979	313	4,292	1,956
Wyoming and Nebraska	3,771	0	3,771	3,725
Total	40,815	8,394	49,209	26,684
Source: USDOI BLM 2014a.				

TABLE 3-8
Cultural Resources on Public Lands

State	Number of Acres (in millions)	Number of Acres Surveyed	Percent of Acres Surveyed	Number of Properties Recorded
Alaska	72.4	179,759	0.2	3,831
Arizona	12.2	980,953	8.0	13,953
California	15.3	2,135,675	14.0	34,522
Colorado	8.3	1,838,771	22.2	47,035
Idaho	11.6	2,581,358	22.3	17,753
Montana, North Dakota, and South Dakota	8.3	1,522,922	18.3	11,389
Nevada	47.8	3,000,829	6.3	57,688
New Mexico, Oklahoma, and Texas	13.6	1,771,607	13.0	39,209
Oregon and Washington	16.5	1,880,146	11.4	15,578
Utah	22.8	2,794,218	12.3	50,679
Wyoming and Nebraska	18.4	3,249,624	17.7	49,424
Total	247.2	21,935,862	8.9	341,061
Source: BLM Public Land Statistics (USDOI BLM 2008b, 2009b, 2010a, 2011, 2012a, 2013a).				

The cultural heritage for public lands administered by the BLM in 17 western states extends back to approximately 13,000 years BP. As one moves forward in time, the number and variety of sites increases mainly as a result of the increase in Native populations and, after 500 BP or so, European and Euroamerican immigration.

Table 3-8 summarizes the number of acres of public lands inventoried for cultural resources, the number of properties found on public lands, and the number of properties listed in the National Register of Historic Places (NRHP).

American Indian and Alaska Native Cultural Resources

A brief review of the archaeology and ethnography of culture areas within the study area was provided in the 2007 PEIS (USDOI BLM 2007a:3-45 to 3-53). This review covers the Arctic and Subarctic (Alaska), the Northwest Coast, the Southwest, the Great Basin, the Plateau, California, and the Plains Culture Areas. Table 3-9 provides a summary of this information.

TABLE 3-9
Culture Areas, Prehistoric Occupation Periods, and Selected Common Site Types

Culture Area	Paleoindian	Middle Period or Archaic	Late or Sedentary Period
Arctic and Subarctic	13,000+ to 9,000 B.P. Open campsites Cave or rockshelter occupation sites Animal kill and lithic processing sites	9,000 to 6,000 B.P. Semi-subterranean houses Open campsites and tent camps	6,000 to 250 B.P. Semi-subterranean house villages Open campsites and tent camps
Northwest Coast	12,500+ to 6,000 B.P. Open campsites Cave or rockshelter occupation sites		6,000 to 250 B.P. Large, cedar plank pithouse villages Fortified sites Seafood capture or processing sites Pictograph and petroglyph sites
California	11,000(?) to 8,000 B.P. Open campsites Animal kill or processing sites	8,000 to 5,000 B.P. Open campsites and coastal villages Plant or seafood processing sites	5,000 to 250 B.P. Large coastal villages Burial mounds Extensive seafood, sea mammal, and plant processing sites Pictograph and petroglyph sites
Great Basin	11,500+ to 8,000 B.P. Open campsites Cave occupation sites Lithic processing sites	8,000 to 4,000 B.P. Cave or rockshelter occupation sites Pithouse villages Plant and lithic processing sites Fishing sites	4,000 to 250 B.P. Cave or rockshelter occupation sites Small pithouse villages Plant and lithic processing sites Storage pits Pictograph and petroglyph sites
Southwest	11,500 to 8,000 B.P. Open campsites Animal kill and lithic processing sites Cave occupation sites	8,000 to 2,000 B.P. Open campsites Cave or rockshelter occupation sites Pithouses and storage pits Waddle and daub structures Lithic processing sites Pictograph and petroglyph sites	2,000 to 250 B.P. Pithouse villages Storage pits Above-ground structures (Pueblos) Below-ground structures (Kivas) Irrigation ditches and roads Navajo hogans and pueblitos Pictograph and petroglyph sites
Plains	12,000 to 8,000 B.P. Open campsites Cave or rockshelter occupation sites Animal kill and lithic processing sites	8,000 to 2,000 B.P. Open campsites Cave or rockshelter occupation sites Pithouses and storage pits Tipi ring sites Cairns and cairn lines Animal kill, lithic, and plant processing sites	2,000 to 250 B.P. Open campsites and tipi ring sites Waddle and daub structures Earthlodge villages Burial mounds Storage pits Cave or rockshelter occupation sites Small pithouse villages Cairns and cairn lines Animal kill, lithic, and plant processing sites Pictograph and petroglyph sites
Plateau	12,500 to 8,000 B.P. Open campsites Cave or rockshelter occupation sites Fishing sites Lithic processing sites	8,000 to 4,000 B.P. Open campsites Small pithouse villages Cave occupation sites Animal or fish processing sites Lithic processing sites Plant processing sites	4,000 to 250 B.P. Pithouse and longhouse villages, often with burials Open campsites Cave occupation sites Storage pits Animal or fish processing sites Lithic and plant processing sites Pictograph and petroglyph sites

European Settlement Resources

The earliest Euro-American contacts with the western U.S. and Alaska, which typically began with exploration or trading, started in the 1500s in the Southwest and California. By the late 1700s and early 1800s much of what is now the western U.S. was being traversed by explorers and fur traders. A summary of these encounters and the European settlement resources present with the seven culture areas is provided in the 2007 PEIS (USDOI BLM 2007a:3-54 to 3-56).

Public lands in the West contain cultural resources representing all major periods and events in the broad sweep of Euro-American history. The most common rural manifestations of these dominant themes include transportation resources such as ferry sites, railroads, trails, and roads; military sites (training grounds and battlefields); and mining resources related to exploration (prospect pits), extraction (adits, hydraulic cuts, and quarries), and processing (smelters and mills). Other resources include homesteading, ranching, and farming resources (human and animal shelter and irrigation development); fishery resources (boats, fish traps, and weirs); and logging resources (stumpage, sawmills, and human and animal shelter). Evidence of community development includes rural schools, stores, churches, and community centers. Recreation and leisure sites include cabins, resorts, and trail systems.

Important Plant Uses and Species Used by American Indians and Alaska Natives

Although universally important, plant use by Native American and Alaska Native groups is extremely varied, both by region and by group. Subsistence use of such plant products as roots and tubers, stalks, leaves, berries, and nuts is essential to Native people. Vegetation also provides habitat for important wildlife species.

Most Native American and Alaska Native groups constructed a variety of residential shelters and other buildings such as ceremonial lodges and sweat houses, using a combination of materials, usually employing a locally derived hardwood as part of the structural frame. The frames were then covered with other readily available materials, such as planks, mats, and brush. Wood has been burned to cook food, warm dwellings, and facilitate toolmaking. Trees have been fashioned into various types of watercraft and terrestrial hauling

devices. Various woods have been carved or used to produce utilitarian implements like bowls and spoons, and also ceremonial items, such as pipes and totems, and many other items of material culture.

The use of plants for medicinal purposes is widespread. Plants such as sweetgrass, cedar, and sage (referring to both *Salvia* and *Artemisia* spp.), have seen important religious and other ceremonial uses. The use of grasses and other plant resources for basket, box, and tool making also can be observed in the cultures of numerous Native American and Alaska Native groups. Plant products also have been used to make textiles, cordage, and matting, as well as to tan hides. The use of plant dyes, paints, and soaps is widespread.

Visual Resources

Public lands have a variety of visual (scenic) values that warrant different levels of management. Visual resources in these landscapes consist of land, water, vegetation, wildlife, and other natural or man-made features visible on public lands. Vast areas of grassland, shrubland, canyonland, and mountain ranges on public lands provide scenic views. Surface-disturbing impacts on public lands have the potential to impact scenic views. Visual Resource Management (VRM) is the BLM's system for protective management of scenic values and minimizing the visual impacts of surface-disturbing activities.

Different levels of scenic values require different levels of management. The VRM system provides a way to identify and evaluate scenic values to determine the appropriate levels of management. The VRM system has two stages: land use planning and land use plan implementation. The land use planning stage involves inventory of scenic values (Visual Resource Inventory [VRI] Classes) and designation of visual management decisions (VRM Classes). The land use plan implementation stage involves visual impact analysis, mitigation to reduce adverse visual impacts, and determination of conformance to the land use plan VRM Class designations.

BLM lands are inventoried for three scenic values: 1) scenic quality, 2) public sensitivity for the scenic quality, and 3) distance zones. VRI Classes are assigned based on systematic procedures that combine the three inventory factors, as outlined in BLM Handbook H-8410-1, *Visual Resource Inventory* (USDOI BLM 1986a). There are four VRI classes, with VRI Class I and II representing areas with the highest visual value

and VRI Class IV representing landscapes with lowest visual value. The VRI information is taken into consideration with the other natural and cultural resource values and resource allocations to determine VRM Classes during the land use planning process.

VRM Classes have established management objectives which land use authorizations must meet to be in conformance with the land use plan (USDOI BLM 1986a). VRM classes range from Class I to IV, with Class IV allowing for the most visual change to the existing landscape and Class I allowing for the least (Table 3-10).

During the analysis stage, the potential visual impacts from proposed activities or developments are assessed to determine whether the potential visual impacts will meet the management objectives for the area. A visual contrast rating is used, in which the project features are compared with the major features in the existing landscape using the basic design elements of form, line, color, and texture. This process is described in BLM Handbook H-8431-1, *Visual Resource Contrast Rating* (USDOI BLM 1986b). Activities or modifications in a landscape that repeat the basic design elements are thought to be in harmony with their surroundings. Modifications that do not harmonize are said to be in contrast with their surroundings.

Wilderness and Other Special Areas

The BLM manages certain lands that possess unique and important historical, anthropological, ecological,

biological, geological, and paleontological features. These features include undisturbed wilderness tracts, critical habitat, natural environments, open spaces, scenic landscapes, historic locations, cultural landmarks, and paleontologically rich regions. Special management is administered with the intent to preserve, protect, and evaluate these significant components of our national heritage. Most special areas are either designated by an Act of Congress or by Presidential Proclamation, or are created under BLM administrative procedures.

The NLCS is the primary management framework for these specially designated lands. Of the nearly 247 million acres administered by the BLM, approximately 27 million acres are managed under the NLCS program. The NLCS designations primarily include National Monuments, National Conservation Areas, Designated Wilderness and WSAs, National Scenic and Historic Trails, and Wild, Scenic, and Recreational Rivers (Map 3-7 and Table 3-11; USDOI BLM 2013a).

Outside of the NLCS framework, the BLM manages other special areas, including Areas of Critical Environmental Concern (ACECs), Research Natural Areas, National Natural Landmarks, National Recreation Trails, and a variety of other area designations. The BLM uses the ACEC designation to highlight public land areas where special management attention is necessary to protect and prevent irreparable damage to important historical, cultural, and scenic values; fish or wildlife resources; or other natural systems or processes. The ACEC designation may also be used to protect human life and safety from natural hazards.

TABLE 3-10
Visual Resource Management Classes and Objectives and Appropriate Management Activities

VRM CLASS	Visual Resource Objective	Change Allowed (Relative Level)	Relationship to the Casual Observer
Class I	Preserve the existing character of the landscape. Manage for natural ecological changes.	Very Low	Activities should not be visible and must not attract attention.
Class II	Retain the existing character of the landscape.	Low	Activities may be visible, but should not attract attention.
Class III	Partially retain the existing character of the landscape.	Moderate	Activities may attract attention but should not dominate the view.
Class IV	Provide for management activities which require major modification of the existing character of the landscape.	High	Activities may attract attention, may dominate the view, but are still mitigated.

TABLE 3-11
National Landscape Conservation System and Other Special Designation Areas on Public Lands as of September 2011

State	National Landscape Conservation System Area														Non-NLCS Area	
	Outstanding Natural Areas, Forest Reserve, and Cooperative Management and Protection Areas		National Monuments		National Conservation Areas		Wilderness Areas		Wilderness Study Areas		Wild, Scenic, and Recreational Rivers		National, Historic, and Scenic Trails		Acres of Critical Environmental Concern	
	# of Sites	Acres	# of Sites	Acres	# of Sites	Acres	# of Sites	Acres	# of Sites	Acres	# of Sites	Acres/Miles ¹	# of Sites ²	Miles	# of Sites	Acres
Alaska	-	-	-	-	1	1,208,624	-	-	1	326,000	6	609,280/952	1	149	52	8,682,156
Arizona			5	1,774,213	3	119,234	47	1,397,106	2	63,930	-	-	3	122	58	774,124
California	2	7,560	3	301,899	1	56,167	86	3,834,292	67	812,566	8	24,800/108	4	612	185	5,320,721
Colorado			1	170,965	3	398,668	5	205,814	54	548,219	-	-	2	86	71	517,785
Idaho			1	274,693	1	470,840	7	517,362	44	655,512	16	313 miles	5	452	102	591,671
Montana			2	375,027	-	-	1	6,347	39	449,963	1	89,300/149	3	358	54	380,795
Nebraska			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nevada			-	-	3	1,045,668	45	2,055,005	63	2,552,457	-	-	3	1,147	51	1,459,704
New Mexico			2	9,379	2	256,207	5	169,523	58	958,751	2	22,720/71	3	348	153	1,023,241
North Dakota			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oklahoma			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oregon	2	496,258	1	55,930	-	-	8	247,993	88	2,653,135	25	255,916/812	3	68	181	810,738
South Dakota			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Texas			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Utah			1	1,866,134	2	108,317	18	260,273	86	3,234,465	11	20 miles	3	583	59	764,782
Washington			-	-	-	-	1	7,140	1	5,636	-	-	1	12	15	19,378
Wyoming			-	-	-	-	-	-	42	574,401	-	-	6	1,816	42	571,626
Total	4	503,818	16	4,828,240	16	3,663,725	223	8,700,855	545	12,835,035	69	1,002,016/2,425	16	5,753	1,023	20,916,721

¹ Only miles (no acreages) are given for wild, scenic, and recreational rivers designated after 2000.
² Figures in the number column do not add up to the total shown at the bottom areas may cross state lines and are reported in the count for each state.
 Sources: USDO IBLM 2012a, 2013f.

Additional discussion of NLCS lands and ACECs is provided in the 2007 PEIS (USDOI BLM 2007a:3-56 to 3-58). Table 3-11 summarizes current information about these areas on BLM administered lands. A total of 1,024 areas comprising nearly 21 million acres are designated as ACECs; 46 areas comprising more 400,000 acres are designated as National Natural Landmarks; and 192 areas comprising over 500,000 acres are designated as Research Natural Areas. An additional 36 million acres fall under various other designations, such as the Lake Totatonten Special Management Area, the Santa Rosa Mountains National Scenic Area, HMAs, and Globally Important Bird Areas. In addition, more than 3,300 miles of vehicle routes and trails are designated as National Backcountry Byways and National Recreation Trails (USDOI BLM 2012a). The BLM also cooperates with the National Park Service in implementing the National Natural Landmark Program as it applies to public lands. The National Park Service, through the National Natural Landmark Program, designates significant examples of the Nation's ecological and geological heritage.

Recreation

Public lands provide visitors with a wide range of recreational opportunities, including hunting, fishing, camping, hiking, dog mushing, cross-country skiing, boating, hang gliding, OHV driving, mountain biking, birding, viewing scenery, and visiting natural and cultural heritage sites. In addition to the recreational opportunities afforded the public by wilderness and other special areas discussed earlier, the BLM administers more than 3,650 recreation sites and 380 Special Recreation Management Areas, 9,000 miles of floatable/boatable rivers and lakes, 54 National Back Country Byways, 5,750 miles of National Scenic, Historic, and Recreational Trails, and thousands of miles of multiple use trails used by motorcyclists, hikers, equestrians, and mountain bikers (USDOI BLM 2012b, d).

The BLM's long-term goal is to provide opportunities to the public for environmentally responsible recreation. Over 4,000 communities with a combined population of 40 million people are located within 25 miles of public lands, and more than 100 million acres of public lands are located within a day's drive of a major urban area (USDOI BLM 2012b).

In 2010, the America's Great Outdoors initiative, a presidential conservation and recreation agenda, was launched. This initiative has increased awareness of,

and expanded opportunities for, recreational opportunities on BLM-administered lands.

BLM field offices reported 57.8 million recreational visits to BLM public lands and waters in FY 2011, a decrease of 1 percent from the previous year. The total amount of time spent on public lands, reported as visitor days, was estimated at 67 million visitor days, an increase of less than 1 percent from the previous year (Table 3-12; USDOI BLM 2012a).

TABLE 3-12
Estimated Recreation Use of Public Lands During
Fiscal Year 2011

State	Number of Visitor Days ¹ (thousands)		
	Recreation Sites	Dispersed Areas	Total ²
Alaska	196	434	630
Arizona	9,187	1,540	14,554
California	11,523	3,907	15,486
Colorado	1,549	5,083	6,757
Idaho	1,337	3,177	4,542
Montana, North Dakota, and South Dakota	1,081	2,965	4,046
Nevada	1,917	3,225	5,379
New Mexico, Oklahoma, and Texas	457	1,139	1,605
Oregon and Washington	3,387	3,853	7,411
Utah	1,835	2,939	4,822
Wyoming and Nebraska	674	1,003	1,697
Total	33,143	29,265	66,929

¹ One visitor day equals 12 visitor hours.
² Includes visitor days for recreation lease sites and recreation partnership sites.
 Note: Columns may not add up to totals due to rounding.
 Source: BLM Public Land Statistics (USDOI BLM 2012a).

The greatest number of visitor days in FY 2011 occurred in Arizona and California. Overall, developed recreational sites were used about as frequently as non-developed dispersed areas. Recreational use of public lands consists predominately of camping and picnicking, which represented 42 percent of all visitor days in 2011. Other important recreational activities include off-highway travel (12 percent); non-motorized travel, such as hiking, horseback riding, and mountain biking (10 percent); hunting (8 percent); and viewing public land resources and interpretation and education (7 percent). The remaining visitor days were associated with driving for pleasure, special events, sports and

activities, power and non-power boating, fishing, and swimming. Snow- and ice-based activities, such as cross-country skiing, snowmobiling, and snowshoeing, represented less than 1 percent of visitor days (USDOI BLM 2012a).

Commercial revenues generated by recreation on BLM lands are discussed in the Social and Economic Values section of this chapter.

Rights-of-way, Facilities, and Roads

Rights-of-way

Under FLPMA and the Mineral Leasing Act provisions, the BLM issues ROW grants to authorize the construction, operation, and maintenance of a wide range of projects on public lands. These include petroleum pipelines, electrical transmission lines, telecommunications lines, energy development and distribution facilities, water facilities, communication sites, and roads. The ROWs are issued for a specific term for the use of public lands. In FY 2011, there were nearly 104,000 ROWs on public lands, and the BLM issued nearly 2,700 new grants (USDOI BLM 2012a).

The length and width of an ROW (and the resulting acreage of public lands) is dependent on a variety of physical and operational factors, including topography, geology, safety, type of use or uses proposed within the ROW, current technology, and access needs. Individual ROWs may also be subject to controls or limitations prescribed by law or identified in BLM land use plans. The BLM encourages the utilization of ROWs in common, where practical, in order to minimize adverse environmental impacts. Land use plans identify ROW corridors for existing and future ROW development.

Vegetation can interfere with ROW site access, facility maintenance, and electric power flow, and pose safety problems for workers and other ROW users. Therefore, ROW grants generally include provisions that authorize the holder to manage vegetation within and adjacent to the ROW using methods approved by the BLM. The scope and intensity of vegetation treatments within ROWs are operationally specific and highly variable. Inspections are conducted periodically to assess vegetation management needs within ROWs. Pre-emergence or post-emergence herbicides can be applied to prevent or control young emerging and existing vegetation. Other types of vegetation treatments may also be utilized.

Invasive plant species may be associated with the open conditions along ROWs. Additionally, vegetation removal activities can result in ground disturbance that facilitates the establishment and spread of these species. The relatively open nature of ROWs makes them attractive to many recreationists, which can facilitate the spread of invasive plants that are present on ROWs.

Facilities and Roads

The BLM operates or oversees operations on numerous facilities on public lands. These include oil, gas, geothermal, and mineral exploration and production sites; numerous campgrounds, 65 interpretive centers, and other recreational facilities; nearly 5,000 buildings and 655 administrative sites; more than 72,000 miles of roads; and communication facilities (USDOI BLM 2012a).

Construction and operations disturbance can often introduce noxious weeds and other invasive vegetation to facility sites and roads. In general, vegetation management at facilities focuses on controlling vegetation that can pose a safety or fire hazard, or is not aesthetically pleasing. In such situations the vegetation is managed using several methods, which can be integrated into an effective management process. Residual herbicides, applied to vegetation before or after emergence, offer extended management in areas where bare ground is required for safety purposes. Mechanical methods, such as mowing, and manual control by hand pulling have been used to manage vegetation along roads, as well as in sensitive areas.

Social and Economic Values

Social/Demographic Environment

The western U.S., including Alaska, is more sparsely populated than the rest of the U.S., containing about 33 percent of the total U.S. population, but comprising approximately 65 percent of the total land area. In 2010, over 102 million people lived in this region, with over 60 million in California and Texas, alone (Table 3-13). Population density is relatively low, averaging about 46 people per square mile (mi²), which is just over half of the national average of nearly 87 people per mi². Density ranges from about 1 person per mi² in Alaska to over 239 persons per mi² in California. Based on 2010 census data, population growth in the western U.S. between 2000 and 2010 was 13.8 percent, which was higher than the national average of approximately 10 percent (U.S. Department of Commerce Bureau of the

TABLE 3-13
Population, Age Distribution, and Race in the Western States and Alaska

State	Population 2010 (thousands)	Percent Change from 2000	Density (per mi ²)	Age Distribution		Percent of Hispanic Origin	Percent of Both Hispanic and Non-Hispanic Origin					
				Percent Under 18	Percent Over 65		Caucasian	African American	American Indian	Asian/Pacific Islander	Other	More than 1 Race
Alaska	710	13.3	1.2	26.4	7.7	5.5	66.7	3.3	14.8	6.4	1.6	7.3
Arizona	6,392	24.6	56.3	25.5	13.8	29.6	73.0	4.1	4.6	3.0	11.9	3.4
California	37,254	10.0	239.1	25.0	11.4	37.6	57.6	6.2	1.0	13.4	17.0	4.9
Colorado	5,029	16.9	48.5	24.4	10.9	20.7	81.3	4.0	1.1	2.9	7.2	3.4
Idaho	1,568	21.1	19.0	27.4	12.4	11.2	89.1	0.6	1.4	1.4	5.1	2.5
Montana	989	9.7	6.8	22.6	14.8	2.9	89.4	0.4	6.3	0.7	0.6	2.5
Nebraska	1,826	6.7	23.8	25.1	13.5	9.2	86.1	4.5	1.0	1.8	4.3	2.2
Nevada	2,701	35.1	24.6	24.6	12.0	26.5	66.1	8.1	1.2	7.9	12.0	4.7
New Mexico	2,059	13.2	17.0	25.2	13.2	46.3	68.4	2.1	9.4	1.5	15.0	3.7
North Dakota	673	4.7	9.7	22.3	14.5	2.0	90.0	1.2	5.4	1.1	0.5	1.8
Oklahoma	3,751	8.7	54.7	24.8	13.5	8.9	72.2	7.4	8.6	1.9	4.1	5.9
Oregon	3,831	12.0	39.9	22.6	13.9	11.7	83.6	1.8	1.4	4.0	5.3	3.8
South Dakota	814	7.9	10.7	24.9	14.3	2.7	85.9	1.3	8.8	1.0	0.9	2.1
Texas	25,146	20.6	96.3	27.3	10.3	37.6	70.4	11.8	0.7	3.9	10.5	2.7
Utah	2,764	23.8	33.6	31.5	9.0	13.0	86.1	1.1	1.2	2.9	6.0	2.7
Washington	6,725	14.1	101.2	23.5	12.3	11.2	77.3	3.6	1.5	7.8	5.2	4.7
Wyoming	564	14.1	5.8	24.0	12.4	8.9	90.7	0.8	2.4	0.9	3.0	2.2
United States	308,746	9.7	87.4	24.0	13.0	16.3	72.4	12.6	0.9	5.0	6.2	2.9
Western States	102,795	15.0	46.4	25.5	11.6	29.6	68.8	6.6	1.9	7.3	11.5	3.9
Western States as a Percentage of Total U.S.	33.3	-	-	35.4	29.6	60.4	31.6	17.4	66.6	49.4	61.7	44.8
Source: U.S. Department of Commerce Bureau of the Census 2011.												

Census 2011). Many of the western states exceeded the national average, with growth rates of 20 percent or higher during this time period. States with the greatest rate of population growth were Nevada (35.1 percent), followed by Arizona (24.6 percent), Utah (23.8 percent) and Idaho (21.1 percent). Population growth was highest in metropolitan areas. Population growth in the western U.S. has slowed from the rate of increase observed during the previous decade.

The age distribution of the population of the western U.S. is similar to the nationwide distribution. Approximately 25 percent of the population is under 18 years of age, while about 12 percent is over 65. Alaska and Utah are slight exceptions, with a higher percentage of people under 18 (26 percent and 32 percent, respectively) and a lower percentage of people over 65 (8 percent and 9 percent, respectively).

Economic Environment

Employment

Between 2007 and 2012, employment fell by 2 percent in the 17 western states, which was slightly lower than the national decline of 3 percent. States with positive employment growth during this period include Alaska, Nebraska, North Dakota, Oklahoma, South Dakota, Texas, and Wyoming. States with the most employment growth were North Dakota (18 percent), Alaska (5.6 percent), and Texas (5.1 percent). States with above average decreases in employment include Nevada (-12.3 percent), Arizona (-8.8 percent), Idaho (-6.8 percent), California (-5.9 percent), Oregon (-4.3 percent), and New Mexico (-3.1 percent; U.S. Department of Labor Bureau of Labor Statistics 2013a).

In 2014, the average annual nationwide unemployment rate was 6.2 percent (Table 3-14). Unemployment rates in the western U.S. were less than the national average, with the greatest unemployment in Nevada (7.8 percent), California (7.5 percent), Arizona (6.9 percent), Oregon (6.9 percent), and Alaska (6.8 percent). The unemployment rate was lowest in North Dakota (2.8 percent), Nebraska (3.3 percent), South Dakota (3.4 percent), and Utah (3.8 percent; U.S. Department of Labor Bureau of Labor Statistics 2015). Unemployment rates were generally higher for African Americans and Hispanics than other races.

Over 33 percent of the nation's employment opportunities, amounting to more than 58 million jobs, are located in the western U.S. (Table 3-15). Employment in the trade and services industries

accounts for over half of the total jobs. Industries related to natural resources, such as agriculture and mining, are important sources of employment and represent nearly half of the nation's agricultural services, forestry, and fishing jobs. Employment in the government and military sector is higher in Alaska than in other states, accounting for 24 percent of total jobs versus about 14 percent overall in the western U.S.

TABLE 3-14
Percent Unemployment for the Western U.S. and Alaska

State	Year			
	1990	2000	2010	2014
Alaska	7.0	6.6	8.0	6.8
Arizona	5.5	3.9	10.4	6.9
California	5.8	4.9	12.4	7.5
Colorado	5.0	2.7	9.0	5.0
Idaho	5.9	4.9	8.7	4.8
Montana	6.0	4.9	6.7	4.7
Nebraska	2.2	3.0	4.7	3.3
Nevada	4.9	4.1	13.8	7.8
New Mexico	6.5	4.9	8.0	6.5
North Dakota	4.0	3.0	3.8	2.8
Oklahoma	5.7	3.1	6.9	4.5
Oregon	5.6	4.9	10.8	6.9
South Dakota	3.9	2.3	5.1	3.4
Texas	6.3	4.2	8.2	5.1
Utah	4.3	3.2	8.1	3.8
Washington	4.9	5.2	9.9	6.2
Wyoming	5.5	3.9	7.0	4.3
United States	5.6	4.0	9.6	6.2
Source: U.S. Department of Labor Bureau of Labor Statistics 2015.				

Income

Based on data from 2008 to 2012, the estimated per capita income in the western U.S. was \$28,575, which was similar to the national average of \$28,051. Per capita income was greatest in Alaska, Colorado, and Washington, and lowest in Utah, Idaho, and New Mexico (U.S. Department of Commerce Bureau of the Census 2014).

In 2011, the median household income in the western U.S. was \$52,376, a 4.1 percent decrease from the previous year. The highest median annual income in the western U.S. was paid to individuals employed by the information sector (\$60,379), followed by public administration (\$58,072), and professional services (\$54,196). The lowest median annual income was earned by those working in agriculture, forestry, fishing,

TABLE 3-15
Percent Unemployment by Industry in 2011

State	Agriculture	Mining and Natural Resources	Construction	Manufacturing	Transportation and Public Utilities	Trade (Wholesale and Retail)	Finance, Insurance, and Real Estate	Information	Services	Government	Total Number (thousands)
Alaska	0.2	6.8	5.2	3.5	5.5	11.3	6.3	1.6	35.6	24.0	454
Arizona	0.8	1.1	4.9	5.0	3.2	14.4	12.4	1.5	43.0	13.6	3,228
California	1.1	1.5	4.3	6.7	3.2	13.3	10.3	2.6	44.0	13.1	19,969
Colorado	1.4	2.1	5.7	4.5	2.8	12.7	11.9	2.6	42.1	14.2	3,200
Idaho	4.4	1.9	5.9	6.8	3.2	14.5	9.4	1.4	38.2	14.4	879
Montana	4.7	3.0	6.4	3.2	3.4	14.0	9.0	1.4	39.5	15.3	629
Nebraska	4.2	1.1	5.1	7.8	5.1	14.1	9.7	1.6	37.2	14.2	1,231
Nevada	0.3	1.4	4.6	2.8	4.0	12.8	12.1	1.2	49.7	11.1	1,498
New Mexico	2.5	3.4	5.6	3.3	2.7	12.9	7.1	1.5	40.9	20.1	1,066
North Dakota	6.1	4.5	6.3	4.7	4.5	15.0	8.1	1.5	33.2	16.0	527
Oklahoma	4.0	6.0	5.4	6.4	3.2	12.8	7.9	1.3	35.8	17.2	2,168
Oregon	3.1	1.5	4.7	8.2	3.0	14.0	8.9	1.8	41.5	13.3	2,222
South Dakota	5.7	1.3	5.7	7.3	3.1	14.9	10.2	1.3	35.5	15.1	564
Texas	1.8	3.5	6.2	6.1	4.0	13.7	10.0	1.6	39.5	13.6	14,611
Utah	1.1	1.2	5.5	7.3	3.5	13.6	12.7	2.1	38.7	14.3	1,658
Washington	2.1	1.2	5.0	7.5	3.0	13.6	8.9	3.0	39.3	16.3	3,829
Wyoming	3.3	9.4	7.5	2.8	4.4	12.2	9.0	1.2	31.1	19.1	391
Western U.S.	1.8	2.3	5.2	6.2	3.5	13.5	10.1	2.1	41.3	14.0	58,124
Source: U.S. Department of Commerce Bureau of Economic Analysis 2012.											

and hunting (\$27,243); portions of the service industry (e.g., accommodation and food services, arts, entertainment, and recreation [\$27,877]); and retail trade (\$34,057; U.S. Department of Labor Bureau of Labor Statistics 2013a).

Environmental Justice

Executive Order 12898 directs federal agencies to address the disproportionately high and adverse human health or environmental effects of their actions on minority and low-income populations. Minority populations are defined as Hispanics, Asian Americans and Pacific Islanders, African-Americans, American Indians, and Alaska Natives. Low income populations are defined as those below the poverty level, which is established by the U.S. Census Bureau. Information on minority and low income populations can be obtained from Census data and then compared to an appropriate statistical reference area.

Given the programmatic nature of this PEIS, it is not feasible to do an analysis of minority and low-income populations based on the complete coverage of BLM-administered lands. These analyses will be done at the

local level for individual treatment programs. Instead, general information for the states covered by this PEIS is provided.

Information on minority populations is provided in Table 3-13. The western U.S. contains a large percentage of the nation's minority populations, including more than 60 percent of the nation's Hispanics and American Indians, and nearly 50 percent of the nation's Asian/Pacific Islanders. In particular, Arizona, California, Nevada, New Mexico, and Texas contain large Hispanic populations, which comprise from 25 to over 45 percent of the total population in each of these states. Almost 15 percent of Alaska's population is comprised of American Indians (Alaska Natives).

The population of the western U.S. living below the poverty level is estimated at 14.8 percent, which is consistent with the national average (U.S. Department of Commerce Bureau of the Census 2014). Table 3-16 presents the percent of people below the poverty level, by state, as compared to the U.S. as a whole. The highest poverty rates occur in New Mexico, Texas, and Arizona, while the lowest rates occur in Alaska and

Wyoming. However, within each state, areas of high poverty may vary geographically, and could include some rural areas where BLM-administered lands are prevalent.

TABLE 3-16
Percent of People Below the Poverty Level for the Western U.S. and Alaska

State	Percent Below Poverty Level
Alaska	9.6
Arizona	17.2
California	15.3
Colorado	12.9
Idaho	15.1
Montana	14.8
Nebraska	12.4
Nevada	14.2
New Mexico	19.5
North Dakota	12.1
Oklahoma	16.6
Oregon	15.5
South Dakota	13.8
Texas	17.4
Utah	12.1
Washington	12.9
Wyoming	11.0
Western Region	14.8
United States	14.9
Source: U.S. Department of Commerce Bureau of the Census 2014 (2008 to 2012 data).	

Revenues Generated by BLM Lands

The BLM allows land use for authorized private commercial activities such as energy and mineral commodity extraction, timber harvesting, livestock grazing, recreation, and the development of ROWs on public land. Tax revenues generated by public land is used to assist state and local governments, support the General Fund of the U.S. Treasury, and offset charges for program operations where certain fees collected can be retained by the BLM. During FY 2011, the BLM collected nearly \$245 million from a variety of land uses in the western U.S. (Table 3-17; USDOJ BLM 2012a). Additionally, royalties collected by the Office of Natural Resources Revenue from leasable minerals produced from federal lands and managed by the BLM are greater than \$4 billion annually. Operating revenues from mineral leases and permits totaled \$11.2 million in FY 2011 (USDOJ BLM 2012a). These receipts include

rental collections from oil and gas ROWs, revenues from developed lands within the Naval Oil Shale Reserve in Colorado, lease rentals and bonus bids from the National Petroleum Reserve in Alaska, and fees related to mining claims, holding fees, and non-operating revenues.

Woodland products are an important commodity and source of revenue generated on public lands. These products include timber; other wood products, such as fuelwood, posts, and poles; and non-wood forest products, such as Christmas trees, cactus, seed, yucca, pinyon nuts, mushrooms, and yew bark. During FY 2006 to 2011, an average of approximately \$28 million was received annually from woodland products harvested from public lands, the majority of which came from timber sales. The average volume of timber harvested annually between 2006 and 2011 was approximately 20 million cubic feet. The revenue generated from timber sales has generally decreased, from \$46.7 million in 1997 to \$19.4 million in 2011 (USDOJ BLM 2007e, 2008b, 2009b, 2010a, 2011, 2012a, 2013a).

Over ninety percent of income from the sale of timber and other vegetative materials is derived from Oregon and California and Coos Bay (Oregon) Wagon Road Grant Lands. Timber sales on other public lands include sales from salvage timber and forest health projects.

Grazing fees are derived using a formula established in the *Public Rangelands Improvement Act of 1978*, which is based on several index factors, including private land lease rates, beef cattle prices, and the cost of production. In 2012, the fee was \$1.35 per AUM, which is the same as the fee in 2011 (USDOJ BLM 2012b). Approximately \$12.9 million was collected in grazing receipts in FY 2011 (USDOJ BLM 2012a). Half of the grazing fees are used by the BLM for rangeland improvements (USDOJ BLM 2012b).

Fees are charged at many public recreation sites to provide for maintenance and improvement, and include access fees for Entrance Permits, Special Area Permits, Daily Use Permits, Commercial, Competitive, and Group Permits, Leases, and Passports. At other locations, generally those without public facilities, no fees are charged. In FY 2011, 90 percent of recreational use on public lands, in terms of visitor days, occurred in non-fee areas (USDOJ BLM 2012a). The BLM also issues special recreation permits to qualified commercial companies and organized groups such as outfitters, guides, vendors, and commercial competitive

TABLE 3-17
Revenues Generated from Public Lands by Source for Fiscal Year 2011

State	Mineral Leases	Timber Sales	Land and Material Sales	Grazing Fees	Recreation Fees	Other ¹	Total
Alaska	\$177,048	\$0	\$147,412	\$0	\$297,636	\$244,200	\$866,296
Arizona	164,145	30	1,148,015	590,660	1,558,148	5,174,916	8,635,914
California	1,150,461	375,327	1,519,999	236,116	3,919,741	15,463,819	22,665,463
Colorado	1,150,587	18,324	544,930	546,467	525,830	1,197,756	3,983,894
Idaho	48,153	669,386	437,872	1,427,646	905,063	2,012,714	5,500,834
Montana	2,275,206	573,232	122,619	1,774,829	392,321	231,322	5,369,529 ²
Nebraska	0	0	0	1,665	0	0	1,665
Nevada	-174,777	26,581	9,702,808	1,937,754	3,874,883	8,515,169	23,882,418
New Mexico	2,640,656	53,824	3,815,706	2,064,872	422,656	2,369,195	11,366,909 ²
North Dakota	3,397	0	712	14,353	0	4,125	22,587
Oklahoma	0	0	0	128	0	0	128
Oregon	53,499	16,959,414	297,646	1,107,627	2,441,837	1,975,359	22,835,382 ³
South Dakota	0	7,753	744	160,483	0	3,500	172,480
Texas	0	0	0	0	0	0	0
Utah	1,392,958	15,714	1,234,071	1,060,156	2,863,376	3,474,791	10,041,066
Washington	0	607,096	82,390	44,903	0	31,261	765,650
Wyoming	2,301,344	90,506	1,688,388	1,961,661	168,434	3,693,095	9,903,428
Multiple ⁴	118,559,009 ⁵	0	0	0	0	0	118,559,009
Total	129,741,686	19,397,187	20,743,312	12,929,320	17,369,925	44,391,222	244,572,652

¹ Includes fees and commissions, ROW rents, rent of land, and other sources.

² Includes Land Utilization Project land purchased by the federal government under Title III of the Bankhead-Jones Farm Tenant Act and subsequently transferred to the USDOI.

³ Includes Oregon and California receipts, Coos Bay Wagon Road receipts, and receipts from public domain sales and other categories.

⁴ These revenues are not broken down by state in the *Public Land Statistics*.

⁵ Includes mining claim and holding fees, application for permit to drill fees, and non-operating revenue. These revenues are not reported by state.

Source: BLM Public Land Statistics (USDOI BLM 2012a).

event organizers who conduct activities on both fee and non-fee lands. Nearly \$17.4 million were collected in recreation fees in FY 2011 (USDOI BLM 2012a).

In FY 2011, sales of public land and material, including receipts from the sale of public land, and the sale of vegetative and mineral materials, totaled nearly \$20.8 million, of which \$6.8 million was from the sale of certain public lands in Clark County, Nevada, near the city of Las Vegas, under the Southern Nevada Public Land Management Act (USDOI BLM 2012a).

In addition to providing revenue for the BLM, all of the major public land resource use categories generate economic activity in the communities and states in which they occur. For example, there are nearly 17,700 grazing permits/leases in force on public lands, supporting nearly 12.4 million AUMs (Table 3-6). Alaska and Texas have no grazing permits/leases in force. The value of these grazing permits/leases and the acreage they entail vary widely depending on the location, soil characteristics, and precipitation. The

availability of public land grazing leases is highly beneficial, if not crucial, to some ranching operations, however, and consequently is very important to many rural communities throughout the West.

Similarly, mineral development is an economic mainstay of many western communities. Table 3-15 illustrates the relative importance to the employment base of mineral extraction, particularly in Alaska, North Dakota, Oklahoma, and Wyoming. Each of these states has a much higher percentage of employment in the mining/natural resource industry than the average for the West as a whole. This industry sector includes oil and gas, coal, aggregates, and hard rock minerals such as gold and copper. Alaska's oil industry not only supports ongoing employment, but also contributes toward minimizing taxes for all state residents and has provided a substantial cash rebate to residents over the years.

The BLM estimates the contribution to local economies from recreation on public lands. These estimates serve

as one example of the economic activity that depends on the public land base. Recreational activity provides revenue for local economies through expenditures associated with activities such as hunting, fishing, and wildlife viewing (Table 3-18). In FY 2012, an estimated \$31 million was injected into local economies through these recreation-associated expenditures (USDOI BLM 2013a). These activities produce indirect economic benefits to community businesses providing food, lodging, equipment sales, transportation, and other services. State fish and wildlife management agencies also benefit from spending associated with these activities from sources such as state tax revenue and state administered fishing and hunting license programs.

Expenditures by the BLM

The budget for the BLM was \$1.1 billion in FY 2014, and was projected to be \$1.1 billion in FY 2015 (USDOI BLM 2014b). In FY 2012, \$960 million was allocated to management of lands and resources (Table 3-19). These expenditures included integrated management of public land, renewable and cultural resources, fish and wildlife, threatened and endangered species, recreation, and energy and minerals.

Wildland Fire Management

While the amount budgeted for wildland fire management may be relatively consistent from year to year, the cost of fighting fires has varied substantially. Since 2009, the BLM's fuels management budget has averaged between \$60 million and \$100 million annually. The total wildland fire management budget for the BLM ranges from \$250 million to \$280 million annually.

Table 3-20 shows the BLM's fire suppression expenditures for recent years. The variability often results from changing weather, but terrain, vegetation, and proximity to populated areas all contribute to the cost of fighting a fire. The cost of fire suppression also depends on the number and size of fires. Approximately 95 percent of wildland fires are controlled in the initial attack, when they are relatively small and not yet seriously out of control. Table 3-21 illustrates the total acreage of USDOI-managed lands burned by unwanted fires in recent years. Between 2008 and 2012, the acreage burned by fires has varied, with the lowest burned area in 2009 and the highest in 2012.

TABLE 3-18
Estimated Benefits to Local Economies by Recreation on Public Lands in Fiscal Year 2011

State ¹	Fishing Expenditures	Hunting Expenditures	Wildlife Viewing Expenditures	Total
Alaska	\$578,759,000	\$140,125,000	\$650,777,000	\$1,369,661,000
Arizona	898,694,000	361,468,000	938,904,000	2,199,066,000
California	2,710,963,000	910,828,000	4,681,133,000	8,302,924,000
Colorado	608,089,000	497,348,000	1,554,265,000	2,659,702,000
Idaho	316,929,000	290,884,000	297,226,000	905,039,000
Montana	253,511,000	347,805,000	421,625,000	1,022,941,000
Nevada	161,990,000	144,570,000	405,696,000	712,256,000
New Mexico	337,233,000	184,025,000	332,835,000	854,093,000
North Dakota	93,729,000	129,114,000	22,913,000	245,576,000
Oregon	556,574,000	418,447,000	869,584,000	1,844,605,000
South Dakota	131,089,000	185,258,000	183,204,000	499,551,000
Utah	415,617,000	306,636,000	632,176,000	1,354,429,000
Washington	904,796,000	313,134,000	1,502,311,000	2,720,241,000
Wyoming	584,056,000	153,737,000	442,253,000	1,180,046,000
Total	8,552,029,000	4,383,379,000	12,934,905,000	25,870,310,000

¹Estimates include only states with more than 50,000 acres of public lands. No estimates were made for Nebraska, Oklahoma, or Texas. Source: BLM Public Land Statistics (USDOI BLM 2012a). Note: Columns may not add up to totals due to rounding.

TABLE 3-19
Summary of BLM Jobs and Expenditures for the Management of the Lands and Resources Program
by Activity and Subactivity (dollars in thousands)

Activity/Subactivity	2013 (Actual)		2014 (Enacted)	
	FTE ¹	Amount	FTE ¹	Amount
Management of Lands and Resources	5,994	\$902,160	6,078	\$956,875
Land Resources	1,417	231,587	1,493	245,474
Soil, Water, Air	227	41,455	227	42,939
Range Management	670	75,955	675	79,000
Forest Management	48	5,889	81	9,838
Riparian Management	171	21,321	169	21,321
Cultural Resources	116	15,131	114	15,131
Wild Horse and Burros	185	71,836	173	77,245
Wildlife and Fisheries	319	61,136	311	64,868
Wildlife Management	232	48,606	225	52,338
Fisheries Management	87	12,530	86	12,530
Threatened and Endangered Species	154	20,326	159	21,458
Recreation	531	63,429	541	66,961
Wilderness Management	151	17,300	155	18,264
Recreation Resource Management	380	46,129	386	48,697
Resource Protection and Maintenance	532	94,749	524	94,749
Energy and Minerals	1,157	110,092	1,261	130,119
Realty and Ownership	512	62,226	484	67,658
Transportation and Facilities Maintenance	341	65,632	335	65,632
Workforce and Organizational Support	442	160,661	434	165,724
National Landscape and Conservation System	244	29,909	253	31,819
Other ²	345	41,988	337	44,109

¹ Full-time equivalent.
² Includes Communications Site Management, Mining Law Administration, and Challenge Cost Share.
Source: USDOJ BLM 2014b.

TABLE 3-20
BLM and USDOJ Fire Suppression Expenditures
Fiscal Year 2007 through Fiscal Year 2013

Fiscal Year	Total Expenditure BLM	Total Expenditure USDOJ
2007	301,114,240	470,491,000
2008	251,381,120	392,783,000
2009	139,787,520	218,418,000
2010	147,976,960	231,214,000
2011	204,024,320	318,788,000
2012	298,132,480	465,832,000
2013	255,487,360	399,199,000
10-year Annual Average	223,749,184	349,608,100

NA = Not applicable.
Source: USDOJ BLM 2014c.

TABLE 3-21
USDOJ Unwanted Wildland Fires
During 2006 to 2012

Calendar Year	Number of Fires	Total Acreage
2006	11,823	2,554,304
2007	8,212	2,896,507
2008	5,778	2,387,484
2009	6,225	511,790
2010	5,786	1,294,546
2011	7,615	1,423,895
2012 ¹	9,151	3,186,827
Total	54,590	14,255,353

¹ 2012 values are estimated.
Source: USDOJ 2014.

Hazardous Fuels Reduction

Reducing the hazardous fuels available to sustain a wildland fire can be costly. The USDOJ treated 733,871 acres in the wildland-urban interface (WUI) during 2012 at an average cost of \$224 per acre. Treatment can cost up to \$5,000 per acre for labor-intensive, small, mechanical treatments in forested WUI areas. During the same year, the USDOJ treated 266,619 acres in non-WUI areas at a cost of about \$69 per acre (USDOJ 2014).

Weed Management

Herbicides and other vegetation management methods are employed to control invasive plant species, which have caused a variety of problems on public lands. The Vegetation section of this chapter addresses several major types of weed infestations on public lands. As Duncan and Clark (2005) noted, “The economic impact of most (weed) species is poorly documented. This is generally due to the lack of quantitative information on ecosystem impacts and the challenge of assessing non-market cost such as those to society and the environment (e.g., changes in fire frequency, wildlife habitat, aesthetics, and loss of biodiversity).”

Expenditures for herbicides used on BLM land are a relatively small part of the agency’s budget. Table 3-22 provides information about the estimated cost per acre for currently approved herbicides. These estimates include only the cost of the chemicals; labor and equipment costs for herbicide application are in addition to the costs shown. The BLM estimated it spent \$12.7 million to treat weeds on approximately 204,000 acres (\$62 per acre) during FY 2012 (Ramos 2014). These costs included herbicide, labor, and equipment costs. The cost of herbicides can vary dramatically, depending on the type selected and the method of application. Costs can also vary significantly by geographic region, vendor, type of chemical (generic versus branded), and size and terrain of the application target area. The BLM’s range of estimated application costs for ground applications is typically \$45 to \$450 per acre for backpack sprayer applications, \$35 to \$450 per acre for all-terrain vehicle (ATV)/utility terrain vehicle (UTV) applications, and \$25 to \$120 per acre for boom sprayer applications. Costs for aerial applications are estimated at \$6 to \$40 per acre for fixed-wing aircraft and \$15 to \$300 per acre for helicopter applications. Occasionally, costs can exceed these ranges, depending on the site conditions. Backpack sprayer applications have been reported as high as \$4,200 per acre, and ATV/UTV

applications have been reported as high as \$800 per acre.

Some herbicide treatments may require reseeding or some other form of site restoration or rehabilitation following herbicide application, particularly large-scale treatments that clear an area of vegetation. The cost of reseeding a site following a treatment varies depending on the extent of work required, and can range anywhere from \$350 to \$1,000 per acre (USDOJ BLM 2014d).

Payments to State and Local Governments

Where the federal government maintains public land, it makes payments to state and local governments for a variety of purposes. Receipts from coal leases and bonus payments, for example, are shared. Payments in lieu of taxes help address the loss of potential local tax income that could have been generated from those public lands if they were in private ownership. Payments in lieu of taxes, as well as other forms of transfer payments, are generally set by law and provided according to a formula. Payments in lieu of taxes, for example, are computed based on the number of acres of public lands within each county and multiplied by a dollar amount per acre. Over \$6 billion in payments have been made since 1976. Table 3-23 shows the BLM payments to states and local governments for FY 2011. Note that this table does not include royalty payments associated with leasable minerals that are returned to the state of origin, which exceeded \$2 billion in FY 2012.

Human Health and Safety

Background Health Risks

This section discusses background information on human health risks of injuries, and cancer and other diseases for people living in the states in which the BLM is planning to implement herbicide treatments. People living in these states are exposed to a variety of risks common to the U.S. as a whole, including automobile accidents and other injuries; contaminants in the air, water, soil, and food; and various diseases. Risks to workers may differ from those facing the general public, depending on the nature of a person’s work. Some of these risks may be quantified, but a lack of data allows for only a qualitative description of certain risks. Where data are only available for the U.S. as a whole, it is assumed that these data apply to the treatment states. Information for this section was obtained from the Centers for Disease Control and Prevention (CDC), the National Center for Injury

TABLE 3-22
Herbicide Uses and Costs for Vegetation Treatments on Public Lands During 2011

Herbicide	Type of Application	Acres Treated¹	Total Herbicide Expenditure²	Cost per Acre for Herbicide²
2,4-D	Aerial	1,571	\$5,216	\$3.32
	Ground	37,380	223,161	5.97
Bromacil	Aerial	0	0	NA
	Ground	6,338	728,836	115.00
Chlorsulfuron	Aerial	3,779	25,508	6.75
	Ground	5,347	64,158	12.00
Clopyralid	Aerial	52,789	831,427	15.75
	Ground	2,104	34,463	16.38
Dicamba	Aerial	128	1,440	11.25
	Ground	11,044	141,691	12.83
Dicamba + Diflufenzopyr	Aerial	0	0	NA
	Ground	38	16	0.41
Diquat	Aerial	0	0	NA
	Ground	17	55	15.50
Diuron	Aerial	0	0	NA
	Ground	9,991	325,306	32.56
Fluridone ³	Aerial	0	0	NA
	Ground	0	0	NA
Glyphosate	Aerial	16,935	73,498	4.34
	Ground	9,861	85,492	8.67
Hexazinone ³	Aerial	0	0	NA
	Ground	0	0	NA
Imazapic	Aerial	17,498	179,355	10.25
	Ground	3,696	53,588	14.50
Imazapyr	Aerial	3,501	69,075	19.73
	Ground	5,938	135,389	22.80
Metsulfuron methyl	Aerial	1,518	2,869	1.89
	Ground	10,398	51,470	4.95
Picloram	Aerial	3,905	45,063	11.54
	Ground	24,938	404,490	16.22
Sulfometuron methyl	Aerial	0	0	NA
	Ground	1,116	6,731	6.03
Tebuthiuron	Aerial	73,493	66,144	0.90
	Ground	133	162	1.22
Triclopyr	Aerial	106,580	576,006	5.32
	Ground	3,176	75,620	23.81
¹ Acres treated do not take into account whether the aerial application was by helicopter or airplane, nor do they distinguish between ground application methods. Costs would vary depending on the application method. ² Total herbicide expenditure and cost per acre do not include costs for labor, equipment, and application, and represent an average cost for use throughout the BLM. ³ Herbicide not applied in 2011, so no data are available. Estimated costs are \$548.63 per pound active ingredient for fluridone and \$42.45 per pound active ingredient for hexazinone. NA = Not available or not applicable.				

TABLE 3-23
BLM Payments to States and Local Governments During Fiscal Year 2011

State	Payments in Lieu of Taxes ¹	Mineral Leasing Act ²	Taylor Grazing Act			Proceeds of Sales	Other	Total Payments
			Section 3	Section 15	Other			
Alaska	\$25,490,863	\$4,064	\$0	\$0	\$0	\$0	\$0	\$25,494,927
Arizona	31,546,890	82,124	48,912	77,642	0	49,480	0	31,805,048
California	38,025,813	598,526	13,018	48,225	0	113,620	0	38,799,202
Colorado	27,022,334	514,788	63,511	29,612	18,632	29,940	0	27,678,817
Idaho	25,592,241	26,452	167,378	19,350	0	123,674	0	25,929,095
Montana	24,717,269	21,204	133,026	103,597	0	8,526	596,776	25,580,398
Nebraska	996,651	0	0	812	0	0	0	997,463
Nevada	22,942,298	105,787	213,384	3,168	0	118,288	1,025,321 ³	33,636,189
New Mexico	32,916,396	1,240,210	214,208	138,216	15	105,467	10,025	34,624,537
North Dakota	1,452,758	1,562	0	7,314	0	6	0	1,461,640
Oklahoma	2,639,362	0	0	65	0	0	0	2,639,427
Oregon	13,062,332	26,823	126,848	28,766	0	9,614	85,486,761 ⁴	98,741,144
South Dakota	4,995,110	0	0	0	0	0	0	4,995,110
Texas	4,629,597	0	0	0	0	0	0	4,629,597
Utah	34,659,277	694,786	132,435	0	0	27,200	0	35,513,698
Washington	13,843,603	0	0	22,651	0	11,505	0	13,877,759
Wyoming	25,656,797	1,084,182	160,744	332,280	31,313	86,234	0	27,351,550
Western States	330,189,591	4,400,508	1,273,464	811,698	49,960	683,554	87,118,883	424,527,658
All States	375,158,254	4,400,508	1,273,464	811,698	49,960	702,420	87,118,883	469,515,187

¹ Payments in lieu of taxes are made by the USDO, Office of the Secretary, for tax-exempt federal lands administered by the BLM, National Park Service, USFWS, and Forest Service, as well as for federal water projects and some military installations.

² These are payments to states of 50 percent of mineral leasing ROW rents.

³ Does not include direct payments of land sales under the Southern Nevada Public Land Management Act and some calendar year payments to Clark County, Nevada and the State of Nevada under the Santini-Burton Act because they were not reported to Treasury in 2012.

⁴ These are Secure Rural Schools and Community-Self-Determination Act payments to 18 counties in Western Oregon authorized by Public Law 110-343.

Sources: USDO 2011, USDO BLM 2012b.

Prevention and Control, the National Center for Health Statistics (NCHS), the National Institute for Occupational Safety and Health (NIOSH), and the Bureau of Labor Statistics.

Risks from Diseases

Disease Incidence

Despite the difficulties in establishing correlations between work conditions and disease, certain illnesses have been linked to occupational hazards. For example, asbestosis and lung cancer among insulation and shipyard workers has been linked to their exposure to asbestos (NIOSH 2012). Pneumoconiosis among coal miners has been correlated with the inhalation of coal dust. Occupational exposures to some metals, dusts, and trace elements, as well as CO, carbon disulfide, halogenated hydrocarbons, nitroglycerin, and nitrates, can result in increased incidence of cardiovascular disease. Neurotoxic disorders can arise from exposure

to a wide range of chemicals, including some pesticides. Dermatological conditions like contact dermatitis, infection, trauma, cancer, vitiligo, urticaria, and chloracne have a high occurrence in the agricultural, forestry, and fishing industries.

Disease Mortality

Mortality rates for the 17 western states in the BLM treatment area are listed in Table 3-24. The five most common causes of death in the U.S., as well as in these 17 states, are heart disease, cancer, respiratory disease, stroke (cerebrovascular diseases), and accidents (CDC 2011). Counties in the western U.S. that have the highest mortality rates are located in southern and eastern North Dakota, central Texas, southern New Mexico, and eastern Montana. Mortality rates are generally lowest in counties in central and western Colorado, Alaska, and northern Utah (CDC 2011). Mortality rates for males are nearly one and a half times those as for females, and mortality rates for African

Americans over one and a quarter times those for Caucasians (CDC 2011).

Risks from Injuries

Injury Incidence

In 2011, nearly 32.4 million nonfatal injuries were reported in the U.S., almost 4.3 million of which were transportation related (CDC 2011). Injuries accounted for 29 percent of emergency department visits during 2010 (CDC 2011).

The rate of hospitalizations for injury is significantly higher among elderly persons than among all other age groups (CDC 2011). In 2010, more than 4,500 U.S. workers died from occupational injuries. Although difficult to enumerate, annually about 49,000 deaths are attributed to work-related illnesses. In 2010, an estimated 3.9 million workers in private industry and state and local government had a nonfatal occupational injury or illness (NIOSH 2012). Some chronic injuries

may be directly linked to the nature of the work performed. For example, vibration syndrome affects a large proportion of workers using chippers, grinders, chainsaws, jackhammers, or other handheld power tools, causing blanching and reduced sensitivity in the fingers. The Bureau of Labor Statistics reported that in 2010, an estimated 29 percent of all work-related illness cases were due to musculoskeletal disorders (NIOSH 2012). Noise-induced hearing loss may also affect production workers who are exposed to noise levels of 80 decibels or more on a daily basis.

Acute trauma at work remains a leading cause of death and disability among U.S. workers. During the period from 1992 through 2011, more than 115,000 U.S. workers died from occupational injuries. The *Census of Fatal Occupational Injuries Summary* (U.S. Department of Labor Bureau of Labor Statistics 2013b) identified 4,693 workplace deaths from acute traumatic injury in 2011. Occupational fatalities resulted from numerous causes, including transportation incidents, falls, contact with objects and equipment, and homicides.

TABLE 3-24
Mortality Rates (per 100,000 Population)¹ and Causes of Death by State 2010

State	Cause of Death				
	All	Diseases		Cancer	Accidents ²
		Cerebrovascular and Cardiovascular Disease	Chronic Respiratory Disease		
Alaska	771.5	192.4	41.5	176.9	58.7
Arizona	693.1	178.6	43.1	154.2	46.7
California	646.7	200.0	37.0	156.9	27.8
Colorado	682.7	168.9	49.7	149.5	43.5
Idaho	731.6	201.3	47.0	159.9	42.1
Montana	754.7	196.0	51.3	161.0	53.2
Nebraska	717.8	194.7	48.8	167.4	35.8
Nevada	795.4	230.6	49.5	174.2	41.3
New Mexico	749.0	189.6	47.7	152.4	60.7
North Dakota	704.3	200.9	43.1	157.1	38.8
Oklahoma	915.5	285.2	67.4	191.3	60.3
Oregon	732.1	178.0	45.3	173.9	37.8
South Dakota	715.1	195.1	46.0	171.0	44.5
Texas	772.3	225.5	43.0	165.9	39.0
Utah	703.2	180.3	33.1	133.7	40.6
Washington	692.3	188.5	40.4	170.5	37.6
Wyoming	778.8	207.0	59.5	172.6	59.8
United States	747.0	218.2	42.2	172.8	38.0

¹ Age-adjusted death rate per 100,000 population, which accounts for changes in the age distribution of the population.
² Accidents do not include motor vehicle accidents.
Source: CDC 2011.

The occupational fatality rate in 2011 was approximately 3.5 fatalities per 100,000 employed. Fatality rates were highest for the agriculture, forestry, fishing, and hunting; mining; transportation; and construction industries. The fatality rate for the agriculture, forestry, fishing, and hunting sector was the highest, at 24.9 fatal industries per 100,000 workers. The mining sector had the second highest rate, at 15.9 fatalities per 100,000 employed. In the transportation and construction industries the rates were 15.3 and 9.1 fatalities per 100,000 employed, respectively. The largest number of fatal work injuries resulted from transportation and warehousing-related incidents, which accounting for 16 percent of workplace fatalities in 2011 (U.S. Department of Labor Bureau of Labor Statistics 2013b).

Injury Mortality

Over 180,000 Americans died from injuries nationwide in 2010. About 20 percent of these resulted from motor vehicle accidents, while other accidental deaths occurred from unintentional falls, drowning, and poisoning (CDC 2011). Injury is the leading cause of death and disability among children and young adults.

Risks from Cancer

Cancer Incidence

Nationwide, the chance of developing some form of cancer during one's lifetime is estimated to be about 40 percent (American Cancer Society 2012). There are many causes of cancer development, including occupational exposure to carcinogens, environmental contaminants, and substances in food. In the U.S., at least 30 percent of all cancer deaths and 87 percent of lung cancer deaths are attributed to tobacco smoking. Work-related cancers are estimated to account for 4 to 10 percent of all malignancies. It is difficult to quantify the information because of the long time intervals between exposure and diagnosis, personal behavior patterns, job changes, and exposure to other carcinogens. The NIOSH has reported that approximately 20,000 cancer deaths and 40,000 new cases of cancer each year in the U.S. are attributable to occupational hazards (NIOSH 2012). Millions of U.S. workers are exposed to substances that have tested as carcinogens in animal studies and it is estimated that

less than 2 percent of chemicals in commerce have been tested for carcinogenicity (NIOSH 2012).

Cancer Mortality

Based on the data shown in Table 3-24, cancer accounted for between 19 and 25 percent of all deaths in the treatment states in 2010. Nationwide, cancers account for approximately 23 percent of all fatalities (CDC 2011). Cancer mortality rates are generally highest in Washington, California, South Dakota, and Oregon, and lowest in Utah, New Mexico, Oklahoma, and Montana, and differ depending on race and sex. Generally, males have higher rates of cancer mortality than females, and African Americans have higher rates than Caucasians.

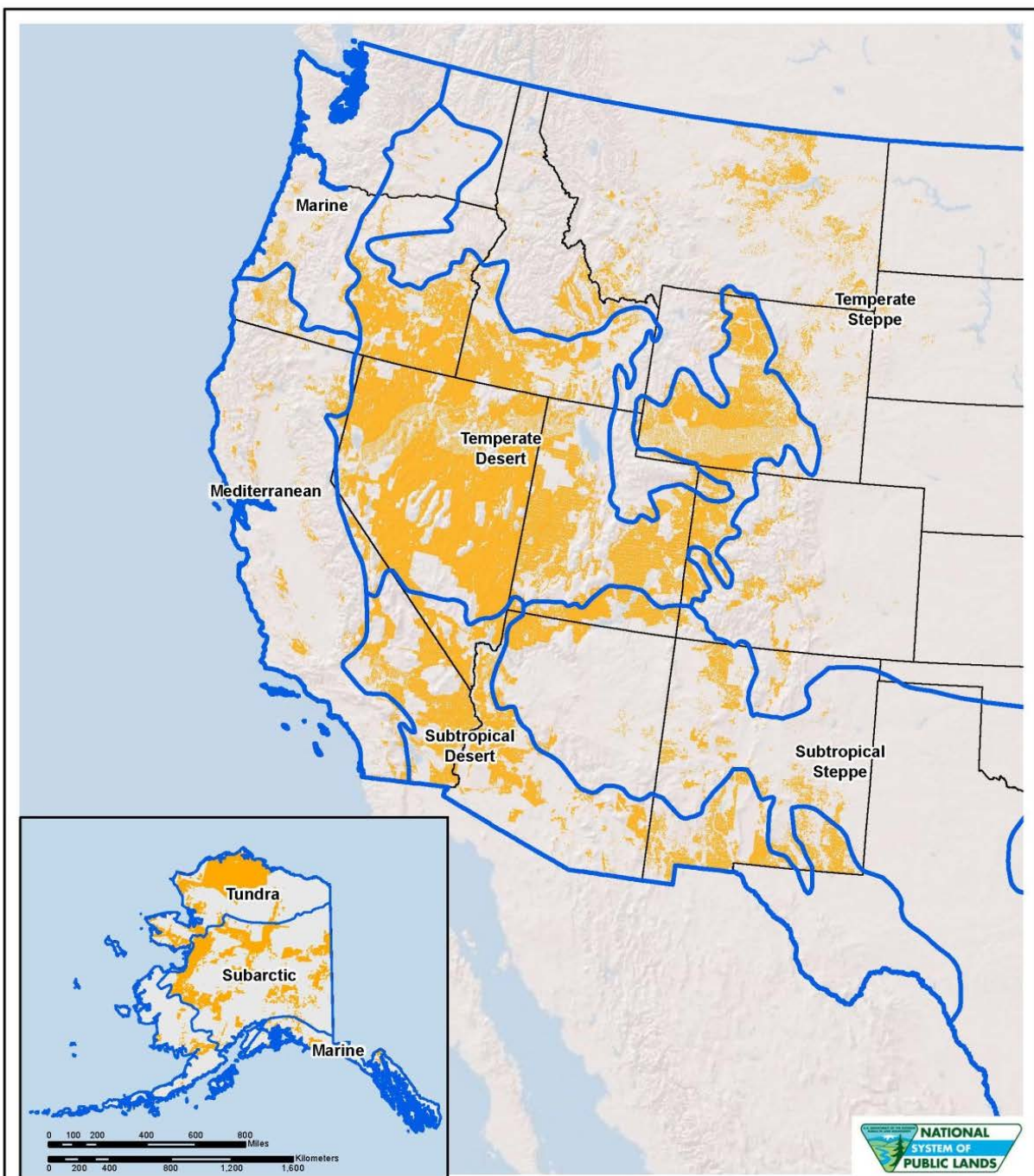
Risks from Using Herbicides on Public Lands

Based on data from the USDOJ accident reporting database (SMIS), there were five accidents involving ATV/UTVs and pesticide application between October 1, 2009 and June 16, 2014.

Risks from Wildfire Control on Public Lands

During FY 2013, 2,573 fires totaling 1,166,649 acres were suppressed on public lands. The number of human-caused fires was 838 and the number of lightning-caused fires was 1,735. Approximately 54 percent of fires occurred on rangelands and other non-forest lands. The remainder occurred in forests (USDOJ BLM 2014e).

Wildfires cause the loss of life and property. According to the National Interagency Fire Center (2014), 34 people died from wildland fire-related accidents in 2013. From 2006 through 2011, the leading cause of firefighter deaths nationally, which include federal, state, and local firefighters and volunteers, as well as private individuals who were involved in direct support of wildland fire operations were: stress/overexertion (51.2 percent), vehicle/aircraft accidents (17.3 percent), and being caught or trapped (9.1 percent; U.S. Fire Administration 2013).

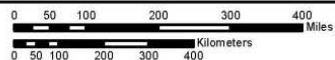


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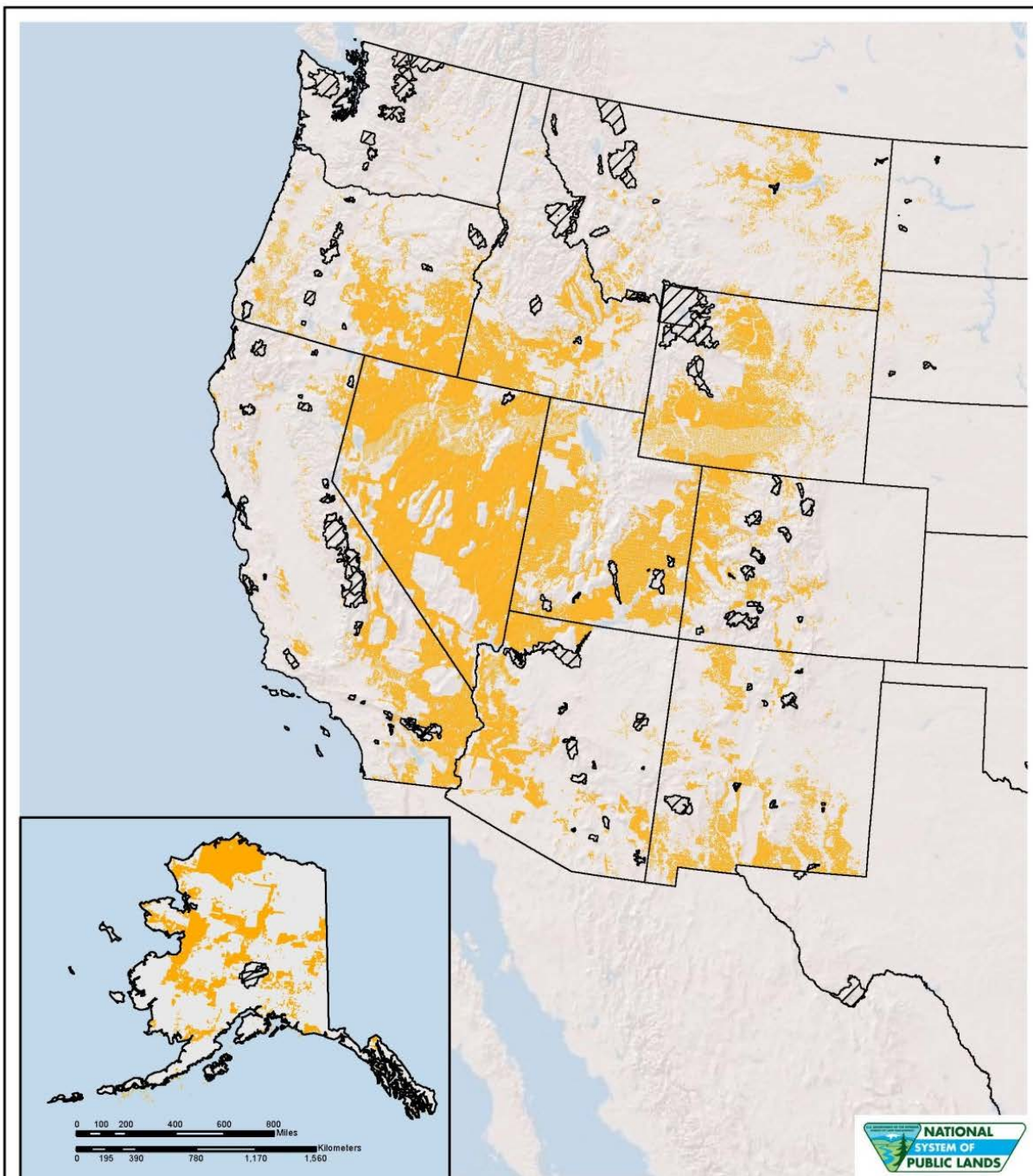
- Ecoregion Divisions
- BLM-administered Lands





Map 3-1 Ecoregion Divisions



Source: USDA Forest Service 2004a.
 Note: Coverage for BLM-administered lands is not available for Texas, Nebraska, or Oklahoma.
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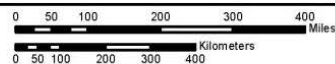


Legend

-  Class I Areas
-  BLM-administered Lands



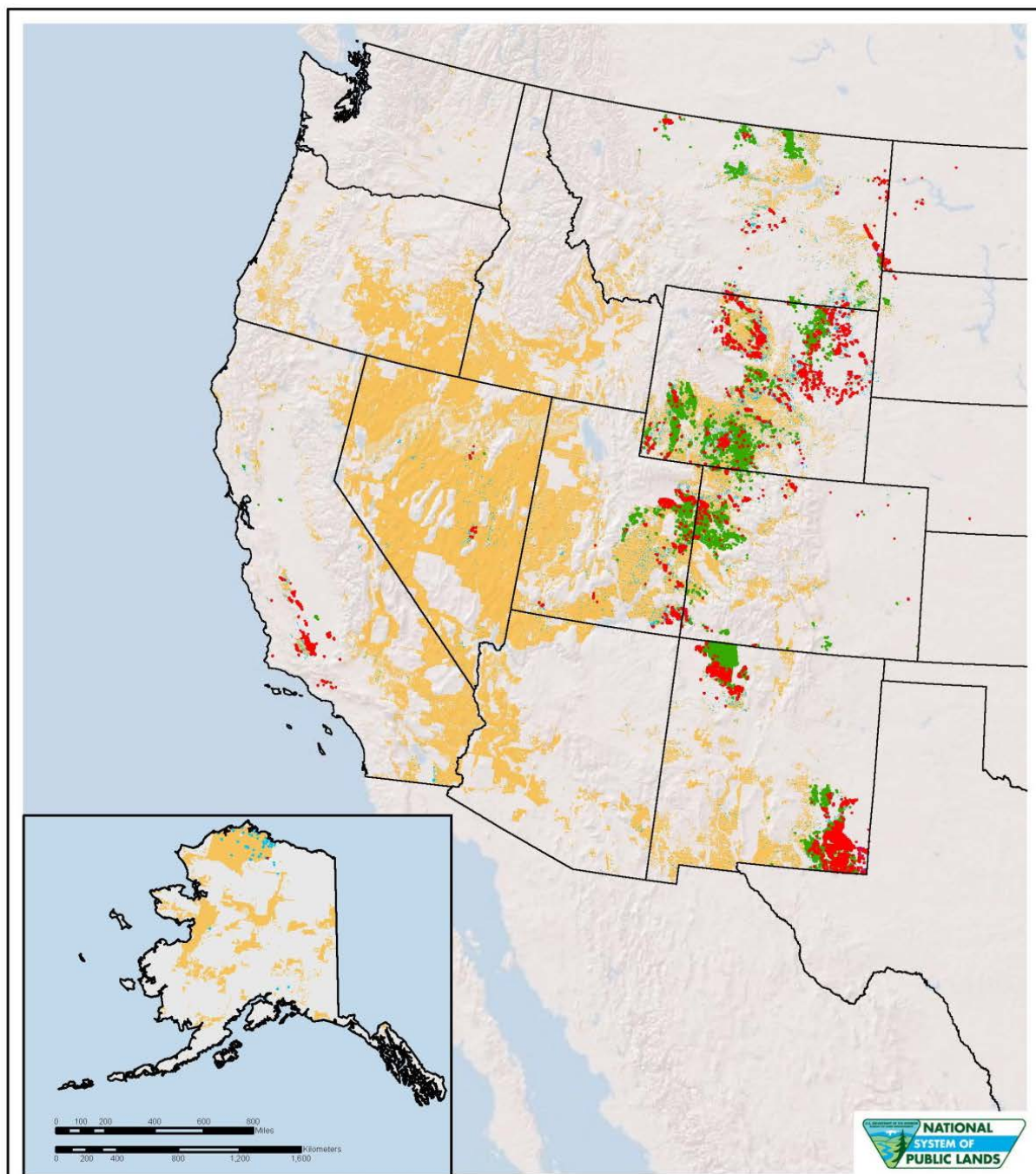
Map 3-2
Class I Areas



Source: National Park Service 2007.

Note: Coverage for BLM-administered lands is not available for Texas, Nebraska, or Oklahoma.

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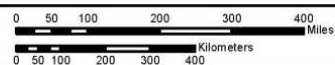


Legend

- BLM-administered Lands
- Oil Production
- Gas Production
- Mixed Production
- Dry Well



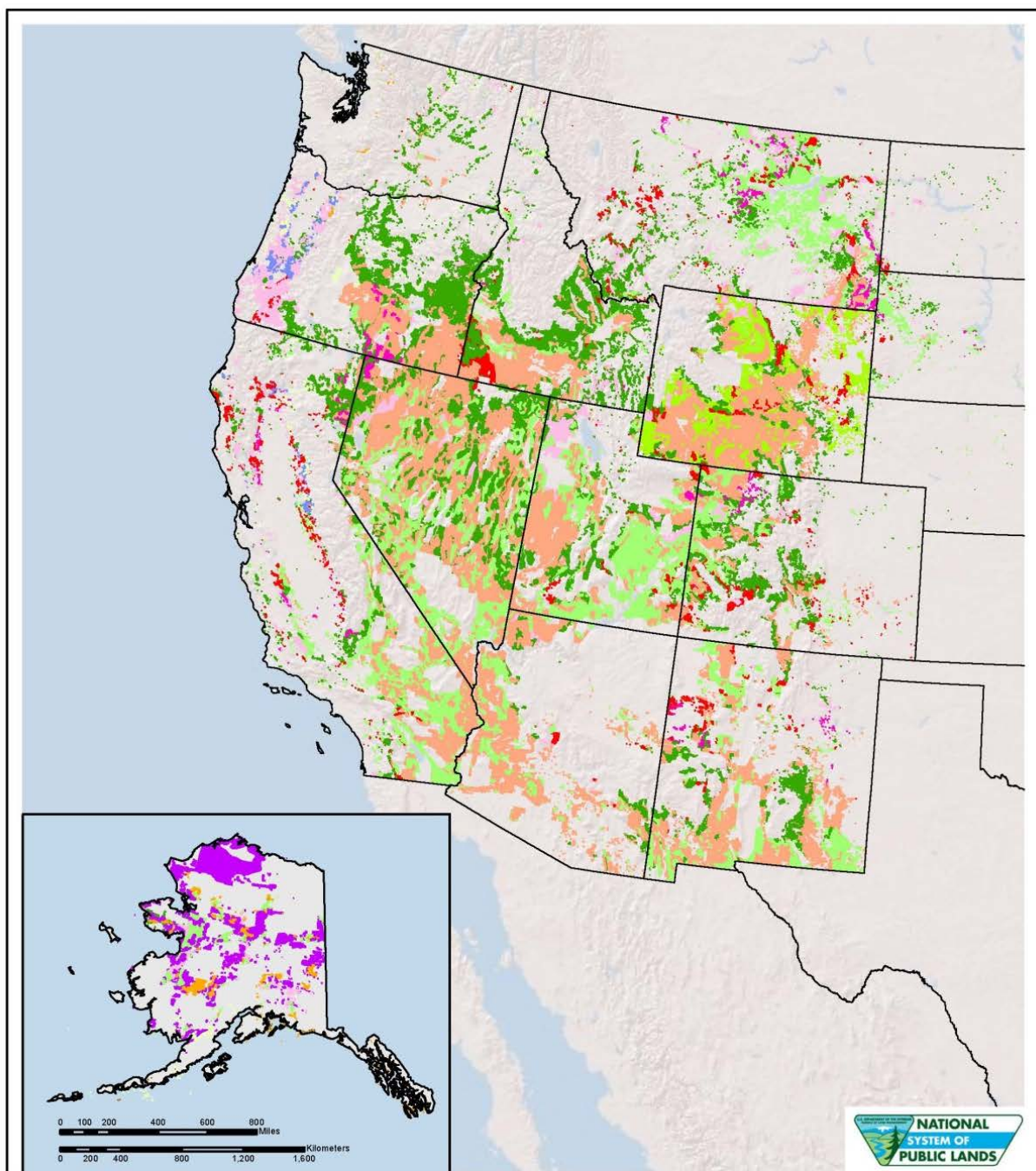
Map 3-3 Oil and Gas Wells on BLM-administered Lands



Source: USGS 2007.

Note: Coverage for BLM-administered lands is not available for Texas, Nebraska, or Oklahoma.

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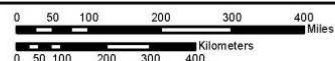


Legend

Alfisols	Gelisols	Spodosols
Aridisols	Histosols	Ultisols
Andisols	Inceptisols	Vertisols
Entisols	Mollisols	

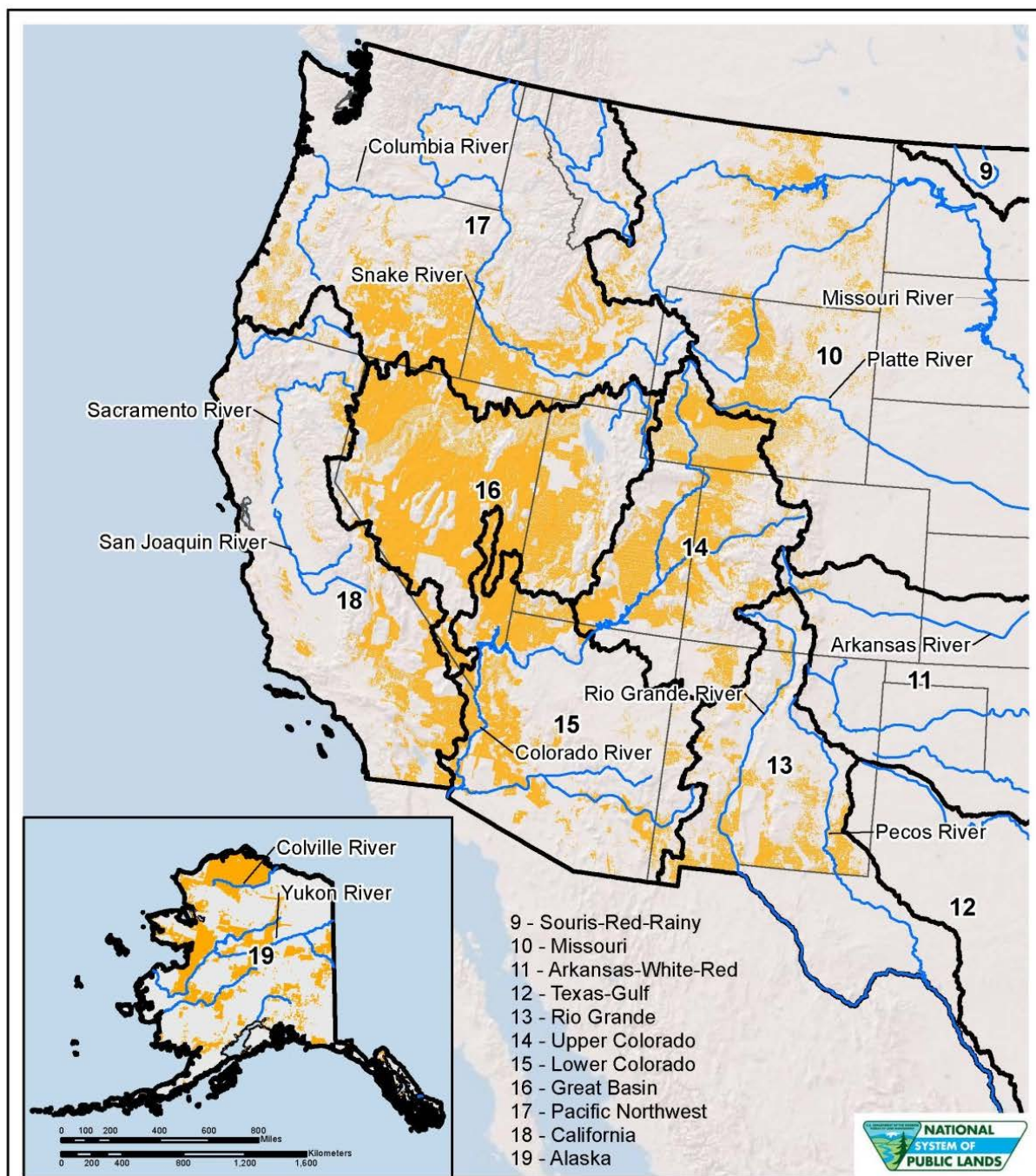


Map 3-4
Soil Orders on Public Lands



Source: USDA National Resources Conservation Service 2000 to Present.
Note: Coverage for BLM-administered lands is not available for Texas, Nebraska, or Oklahoma.

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data.
Original data were compiled from various sources. This information may not meet National Map Accuracy Standards.
This product was developed through digital means and may be updated without notice.



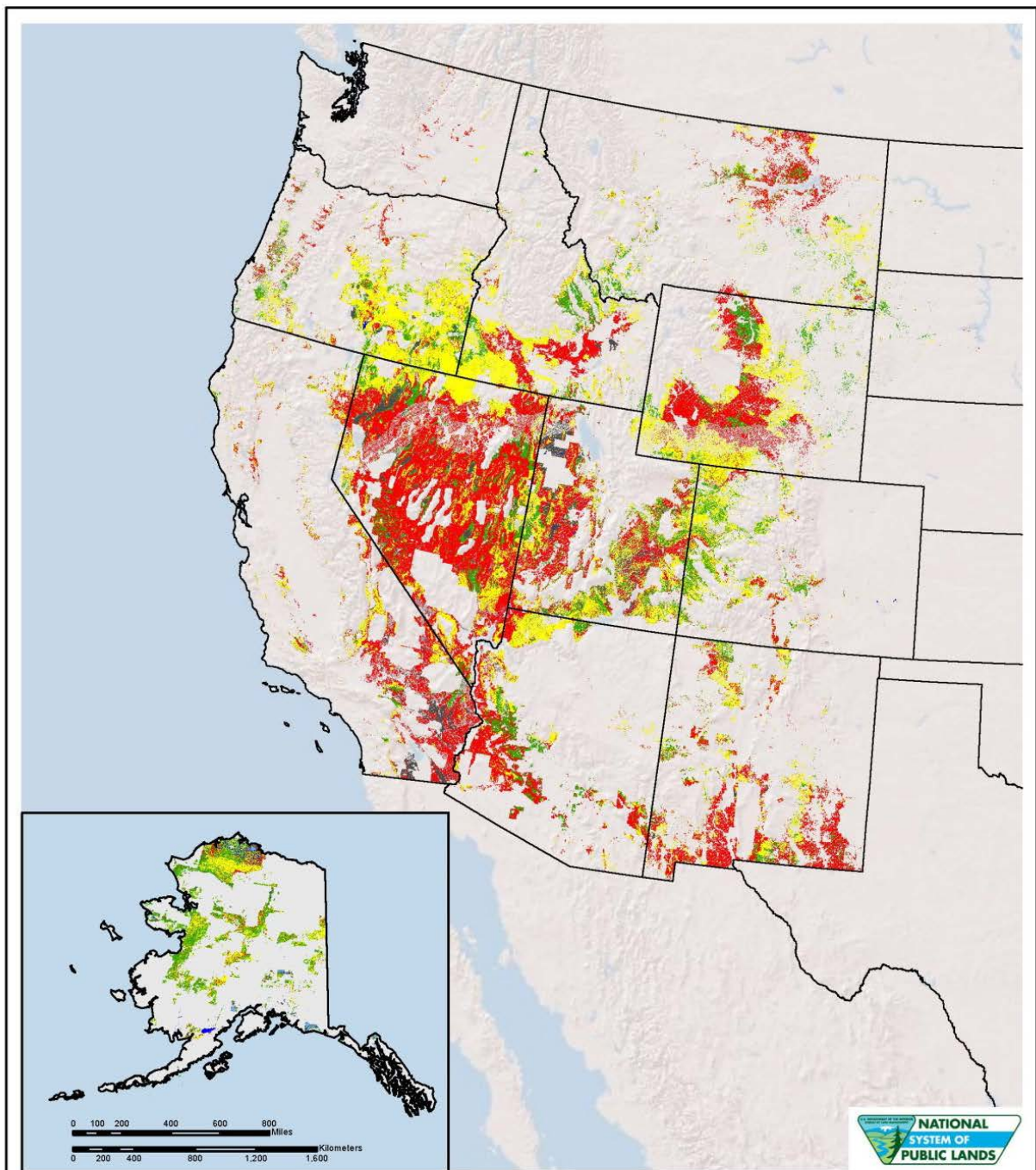
Legend

- BLM-administered Lands
- Hydrologic Regions
- Rivers

Map 3-5
Hydrologic Regions

0 50 100 200 300 400 Miles
 0 50 100 200 300 400 Kilometers

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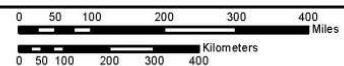


Legend

 Condition Class 1	 Water	 Agriculture
 Condition Class 2	 Snow/Ice	 Barren
 Condition Class 3	 Urban	 Sparsely Vegetated
		 Unclassified



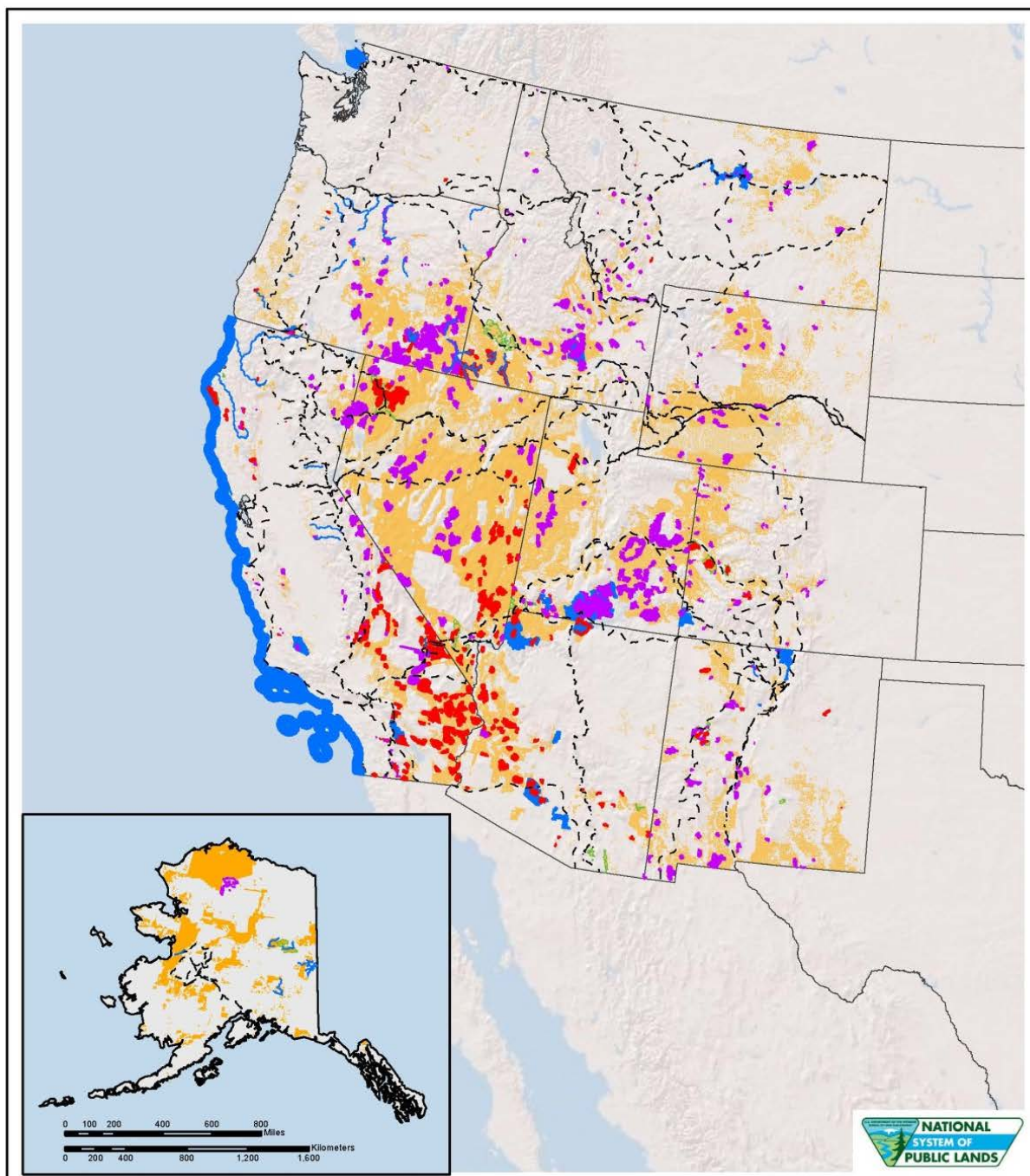
Map 3-6 Fire Regime Condition Classes on Public Lands



Source: Landfire 2010, 2011.

Note: Coverage for BLM-administered lands is not available for Texas, Nebraska, or Oklahoma.

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Legend

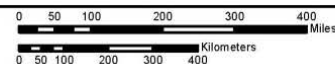
- Scenic or Historic Trails
- Wild and Scenic Rivers
- Wilderness Study Areas
- Wilderness Areas
- National Monuments
- BLM-administered Lands
- National Conservation Areas, Forest Reserves, Cooperative Management and Protection Areas, National Recreation Areas

Sources: USDI BLM 2013h.

Note: Coverage for BLM-administered lands is not available for Texas, Nebraska, or Oklahoma.



Map 3-7 National Landscape Conservation System Areas



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